80th Anniversary of the International Federation for Documentation

TOWARDS THE EVOLUTION OF INFORMATION SYSTEM FOR NATIONAL DEVELOPMENT

NEW DELHI, 8-9 December 1975

SEMINAR PROCEEDINGS

INDIAN NATIONAL SCIENTIFIC DOCUMENTATION CENTRE,
NEW DELHI, 1976.

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The Seminar was organised by INSDOC on behalf of the National Committee for FID to celebrate the 80th anniversary of the International Federation for Documentation (FID). For a non-governmental international organisation which thrives on the voluntary cooperation of members representing heterogeneous political and economic groups and communities, continued existence for eighty years is itself a measure of its usefulness.

Very happily, the FID completes its first eighty years at a time when there is an all round awareness about the importance of information and documentation in any sphere of productive activity. For the creation of this awareness and the prevailing congenial environment, where documentation and information activities can be promoted, the FID itself has been responsible to a large extent. Documentation is no longer the exclusive privilege of only a few scholars. It is now an active force in any type of information transfer and at different levels. Hence, in socio-economic planning also, provision has to be made for not only generation of new information, that is research, but also for its transfer.

It is quite appropriate that our National Committee for FID should think of organising the Seminar to mark the completion of an important year in the eventful history of the FID. So far as the national scene is concerned the Seminar was significant on several counts. It may be recalled that an international FID symposium on the theme of information systems design for socio-economic development was held earlier in Brussels, to celebrate the 80th anniversary of the FID. Hence, the present Seminar was, in a way, the continuation of the same theme considered in the context of India's socio-economic development.

The theme of the Seminar was very significant in view of the fact that a plan for the establishment of a National Information System for Science and Technology (NISSAT) has already been drawn up and is about to be launched. Another significant aspect of the Seminar was that it was attended by a large number of scientists, engineers, consultants, administrators and planners from various organisations and sectors, apart from a large number of workers in the information field and thus provided a common platform for different groups interested in documentation.

The Seminar was held in the spacious auditorium of the National Physical Laboratory and was inaugurated by Mr. P. N. Haksar, Deputy Chairman of the Planning Commission and Vice-President of the Council of Scientific and Industrial Research. In his speech Mr. Haksar observed that the importance of organised information service in our planning activities ought to have been realised much earlier. There were vast gaps in information. Very often work had to be carried on with guess work only. This situation had to be changed. Mr. Haksar exorted the information workers in India to plan for an information system that would eliminate the vast information gaps and help our planners in their activities. He reminded that they have to do it under many constraints, especially the financial constraint.

The other speakers at the inaugural function were Mr. S. Parthasarathy, Scientist-in-Charge, Insdoc, Mr. B. S. Kesavan, former Director of Insdoc, Dr. Peter Lazar, Director of the Hungarian Central Technical Library and Documentation Centre, Dr H. C. Visvesvaraya, Director of the Cement Research Institute, and Mr Y. R. Chadha, Chief Editor of the Publications and Information Directorate.

Mr. Parthasarathy mentioned in brief the activities of the FID highlighting the work and enthusiasm of the two founding fathers. He also outlined India's participation in FID's activities.

Dr. Peter Lazar conveyed the best wishes of the Hungarian information scientists to their Indian counterparts. He mentioned the present activities of the FID in general and the work of the Study Committee FID/DC (Developing Countries) in particular with which he was closely associated. Dr. Lazar assured that the FID would continue to support documentation activities in the developing countries. Apart from Dr. Lazar, the Seminar was attended and addressed by two more distinguished foreign participants, namely, Professor Jean Perreault of the Alabama University and Dr. V. I. Romanov, Director of the Computer Centre, GOST, Moscow.

Dr. Visvesvaraya dwelt at some length, at the inaugural session, on the current information scene in India and felt that information facilities were yet to be organised on a national level. Very often the national point of veiw is lost sight of. To correct the situation a proper systems approach was necessary. He also mentioned the nature of service that is expected from an information worker. It was much more than providing the documents, bibliographies, references and all that. He should be able to provide the exact information, when specified, or suggest the best sources, and even be able to prepare reliable and objective view of the progress of subjects.

The Seminar had four Technical Sessions on the following four areas: 1) National Information System, 2) Industrial Information, 3) Sectoral/Mission Oriented Systems, and 4) Computer-based Information Systems and Manpower Development. The sessions were chaired by Dr. H. C. Visvesvaraya, Dr. V. A. Kamath, Mr Y. R. Chadha, and Brigadier V. M. Sundaram, respectively. Twenty three papers were presented and discussed. The first two papers, by Prof. H. Arntz and by B. Guha, were not presented as they are of general nature describing the policies and activities of the FID.

The First Technical Session opened with the presentation of Mr. S. Parthasarathy's paper. He briefly outlined the NISSAT plan and highlighted the functions of the different categories of agencies at different levels. Dr. N. Vijayaditya, next, presented his paper on National Informatics Centre (NIC), a project of the Electronics Commission. The need for such an information centre to meet the requirement of the central planning machinery, especially in financial and manpower controls, was highlighted and the functions and objectives of such a centre detailed.

Mr M. R. Raman, Planning Commission, presented the next paper on the approach to science and technology planning and the need for a national information grid for rational decision making. Apart from presentation of the above papers, Dr Lazar spoke on national information system and international collaboration bringing out the increased governmental initiative in information activities and the new era of international cooperation.

While discussing the points raised in the papers, doubts were raised as to the exact connotation of the term 'informatics' and also the position of the NIC within the framework of the NISSAT. Dr Lazar, Dr Vijayaditya, and Mr Parthasarathy clarified

these points. It was pointed out that informatics was being used here in its French sense, that is, a computer centre on information. It was also pointed out that NIC is not a parallel system to the NISSAT. NIC could became an element of the NISSAT, mainly with the responsibility of supplying data and factual information. The question of authenticity of information to be supplied also came up for discussion. It was realised that information analysis centres for the cleaning of data had to be created within the framework of the national information system.

The Second Technical Session was devoted to industrial information. The first paper was presented by Mr Y.R. Chadha. He mentioned that many of our workers in industries do not know where exactly a particular piece of information will be available or it may be available in a form which does not meet his requirements. To reach the smallest industrialist, he suggested, something like roving information operators or industrial 'legmen'. The second paper was presented by Mr S. Dutta on behalf of Mr S.V.S. Sharma, Deputy Director of SIET Institute. Mr Dutta emphasised the distinct nature of industrial information specially in the context of small industries and also gave an account of the activities of SENDOC.

Mr A.K. Das Gupta, while discussing the system of collection and publication of industrial data, brought out the difficulties created due to enormous time-lag which is actually increasing. In certain cases data were not available in a form in which they are required. Dr Visvesvaraya considered engineering information synonymous with industrial information and brought out the characteristics of such information. Mr B.S. Krishnamachar, presenting his paper on standards information system for national development, brought out the specialised needs and characteristics of standards information and their importance in the industrial context. Mr N.S. Duggal highlighted the nature of information services required by a consultancy organisation.

The Third Technical Session was devoted to Sectoral/Mission Oriented Information Systems. Ten papers dealing with different sectors of information were presented which together gave an over-all view of the different sectors and their information requirements. The sectors specifically covered were: Nuclear science and technology, development science, agriculture, water resources, climatology, medicine and family planning, and patents. Dr K.S. Parikh provided good examples of information analysis functions in the agricultural sector. Dr R.K. Sanyal brought out effectively the nature of information requirements in health, medicine and family planning. Mr T.S. Rajagopalan explained the concept and functioning of the Branch Information System within the framework of the national information system. Mr S. Vedaraman, Director-General of Patents, Designs, and Trade Marks stressed the need for a strong patent information system for effective transfer of technology and also outlined the functions of such a system.

The Fourth Technical Session had two topics to discuss, namely, computer-based information services and manpower development. Mr A.S. Raizada's paper on the first topic brought out the nature and immense possibilities of computerised services. Mr T.N. Rajan, in his paper, discussed the manpower requirements for manning the various hypes of information services and the facilities available in the country.

At the Concluding Session the following recommendations were made:

1. Recognising the value of scientific and technical information as an important resource for accelerating national development in all sectors and at all levels, the Department of Science and Technology of the Government of India, should launch the

National Information System for Science and Technology (NISSAT) immediately and on a priority basis.

2. Sectoral/Mission oriented information systems, pooling the existing resources available in the country and covering areas of national importance such as Food, Agriculture, Public Health and Family Planning, Human Settlements, Environment, Natural Resources, and Energy which are essential for improving the quality of life of a large majority of our population, should be developed on a priority basis by the Government.

3. Considerable attention should be given to building up expeditiously a strong data base for supporting national planning process and for Government decision-making. This would require a massive concentrated effort for bringing out statistical information generated especially in the government departments, current and meaningful.

4. The Government Departments responsible for generating socio-economic and techno-economic data and reports should evolve suitable mechanisms for making available this information among themselves and to the public expeditiously and efficiently. From the users point of view, timeliness of the information supplied is an essential criterion.

5. Attention should also be paid to building up diversified industrial information services for meeting the requirements of various sectors of industry. Industrial information services, especially for the small scale sector, should be stepped up.

6. Government should build up a strong patent information system. This would contribute to the effective transfer of technology as well as support innovation. This is a large gap in our information system, which should be filled up soon for supporting our industrial development.

7. While developing our national information system, considerable attention should be paid to the application of modern information technology and formulation and adoption of uniform standards for improving our facilities and services. Extensive provision of reprographic equipment should be made in our information centres. Computer facilities should be made available for information processing and for utilising computer-produced data bases. Telelink facilities should be created for quick data transmission and for establishing information network within the country. This would also facilitate our access to international information networks.

8. Adequate facilities should be provided for advanced training for specialised manpower. This would create the necessary expertise for operating our national information system.

9. Government should have adequate provision for supporting projects and programmes in information field for accelerating the development of national information system.

PROGRAMME

8 December 1975

1000 hrs. REGISTRATION

1100 hrs. INAUGURAL FUNCTION

Address by Shri P. N. Haksar, Deputy Chairman, Planning Commission and Vice-President, CSIR

1145 - 1200 hrs. TEA

1200 hrs. TECHNICAL SESSION

Chairman : Dr. H. C. Visvesvaraya
Rapporteur : Shri T. N. Rajan

National Information System for Science and Technology by S. Parthasarathy

National Informatics Centre by N. Vijayaditya

Approach to Science and Technology Planning - Need for a National Information Grid System by M. R. Raman and Hira Lal

Information System for Research and Development in India by S. Vedaraman

International Cooperation in Information Activities by Peter Lazar

1330 - 1430 hrs. LUNCH BREAK

1430 hrs. TECHNICAL SESSION

Chairman : Dr. V. A. Kamath
Rapporteur : Shri B. Guha

Industrial Information in India by Y. R. Chadha and S. K. Nag

Information for Small Industries in India by S. V. S. Sharma

Data Bank and Information System for Small Scale Industries by R. P. Mehta and W. B. Donde

Industrial Data System - A Review of its Scopes and Gaps by A. K. Das Gupta

1600 - 1615 hrs. TEA

Engineering Information Needs and Services by H. C. Visvesvaraya

Standards Information Service for National Development by B. S. Krishnamachar

Information for Industrial Consultancy Organisations by N. S. Duggal

1730 hrs.

Reception by Society for Information Science and Delhi Library Association

9 December 1975

1000 hrs. TECHNICAL SESSION

Chairman : Shri Y. R. Chadha
Rapporteur : Shri B. K. Sen

Nuclear Science Information System by V. A. Kamath

Development Science Information System (DEVSIS) by A. Neelameghan

Agricultural Information Systems by P. C. Bose

Information System for Agricultural Sector by K. S. Parikh

Indian Agricultural Data and Information by S. P. Phadnis and Shoaib Ahsen

1115 - 1130 hrs. TEA

Towards the Evolution of an Information System for National Water Resources, Evaluation, Development, Management and Planning by N. K. Sonavane and V. N. Amble

Climatological Information for National Development by D. Krishna Rao

Developing a National Information System in the fields of Health, Medicine and Family Planning by R. K. Sanyal

Towards Evolving a National Information System in Health and Medical Sciences by C. Dabral and M. K. Bhatt

Branch Information System by T. S. Rajagopalan

1300 - 1430 hrs. LUNCH BREAK

1430 hrs. TECHNICAL SESSION

Chairman : Brig. V. M. Sundaram
Rapporteur : Shri R. Satyanarayana

Development of Computer-based Information Services in India by A. S. Raizada

Manpower Development for Information Work by T. N. Rajan

1545 - 1600 hrs. TEA

1600 hrs. CONCLUDING SESSION

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seminar Papers

LIST OF PAPERS

PAPER A-1

A RETROSPECTIVE VIEW ON THE INTERNATIONAL FEDERATION FOR DOCUMENTATION*

Prof. H. Arntz

President
International Federation for Documentation

Excellencies, Ladies and Gentlemen,

We are assembled here today in order to commemorate the foundation in 1895 of the Institut International de Bibliographie, that IIB which from 1931 called itself the IID, the Institut International de Documentation, and in 1939 assumed its present title, the Federation Internationale de Documentation. Thus it is the 80th birthday of the FID, which means that FID is by far the oldest international organization in the field of information.

Is the foundation of the International Bibliographical Institute exactly 80 years ago an event that concerns only the FID, or does it mark an epoch in the history of information and its control by man? Eighty years are a long period in the history of an organization; in the history of mankind they signify nothing. And yet it is because the history of mankind, throughout its entire length, has been so closely bound up with information that we may say: it is only due to the assimilation, evaluation, processing and utilization of information that the species man became the homo sapiens. We do not know the reason for the biological mutations on the strength of which the human brain, as opposed to that of other living creatures, obtained this particularly pronounced information sense; we see, however, that with the added information, the brain acquired always greater mental powers.

May I illustrate how old not this more instinctive but the systematic utilization of information is by putting forward the example of the Imperium Romanum. A requisite condition for governing an empire of such magnitude at a time in which news depended on runners and horsemen was that, in the headquarters, every one of these fragments of information was carefully collected, evaluated and compared with the items of information already to hand, with the overall view of translating the available information into political, military, legislative and administrative decisions and action. And not only this: when we stand admiringly before the remains of Roman buildings, bridges or aqueducts, we ought to realize, in all humility, how masterly was the documentation organized for - as we would say today - architects and structural engineers. Yes, documentation; for without any doubt the information was collected, classified, evaluated, processed and placed at the disposal of those in need of it. It was possible in this way to govern the Imperium efficiently for long centuries; and, for myself, I have no doubt

Address Delivered on the occasion of the 80th Anniversary of FID at Brussels and reproduced with permission

that the reason why many subsequent empires faded away so quickly was that they did not master the art of utilizing information. Soon thereafter this art was adopted, in a masterly manner, by a new organism which undoubtedly owes a considerable part of its constancy to it - namely, the Roman Catholic Church.

Despite their imposing use, the pieces of information were always only fragment at no time was the totality of human knowledge at hand. The first Empire of the Egyptians knew nothing of the elements of knowledge which set their stamp on Mohenjo Daro and did not possess the thousands of items of information processed there - just as little as the Imperium Romanum knew anything of the contemporaneous Chinese culture. The Spaniards, while destroying the empires of the Aztecs and the Incas, did not possess the capacity to take advantage for themselves of the pieces of information which had accumulated over long centuries in the territories they had conquered and which had led there to the technology and astronomy we find so impressive.

These gaps could perhaps be tolerated (I'll not decide it) as long as the picture of the universe was drawn from religious tradition and religious dogmata - which differed from each other in each territory - or was evolved on the basis of logical concepts. The rounding-off of this epoch is marked by Gottfried Wilhelm Leibniz and Pierre Bayle, the last two universal scholars, if "universal" is restricted to the knowledge of the Occident and that permitted by the Church.

However, with Galilei and Kepler, with Leibniz, Descartes and Newton, the 17th century brought with it a new conception of the universe. In place of speculation came exact observation. Only from then on has there been science in the true sense - science, which Goethe maintains has to serve mankind. Alongside the universities that had already been existing for centuries arose academies, research institutes and learned societies as centres of learning.

For a while it seemed as if science, with its research findings, was again alimenting primarily science. However, the early 19th century already saw the research findings emerging from the domain of science and use being made of them for ordinary, everyday life; we have only to recall industrialization. Human advancement became directly dependent upon the advancement of knowledge and from access to it - thus, from information. Since then, this dependency has increased from day to day.

Apart from man's dependency upon science, his dependency of other people as a result of rapidly advancing specialization has become manifest. Division of labour does not mean that we would anywhere be autonomous, but that we make use - for by far the largest part of our activities - of the experiences and the perceptions of others - thus, of their knowledge; and this in turn means that the pertinent information must be accessible to us. The extent to which we possess this information out of the knowledge we ourselves have gleaned, and, building on our own knowledge, can communicate knowledge to others, is becoming more and more limited from year to year. As against that our own knowledge has to be drawn from ever more and in creasingly specialized research findings, and thus with ever greater effort. Therefore, and again in line with the advancement of knowledge, the spheres in which we are merely the recipients, not capable of taking decisions ourselves are widening at high speed. Consequently, we have to rely increasingly on the bridge of information providing us with reliable access to the knowledge of others. I quote what Hugo Krü , the then Director-General of the Prussian State Library in Berlin, said in 1937 at the World Congress for Documentation in Paris: "We know less and less of constantly more and more, and we know more and more of constantly less and less."

If we reason out this phrase logically, therein lies the whole problems of the information sciences; and there is also paraphrased the task to the solution of which FID must contribute. If everybody has at his disposal only a fraction of human knowledge, but needs the multiple to fulfil his tasks, it must be ensured that to every field which is not his own particular speciality he has an access which permits him to obtain all the information he needs; and to obtain it quickly, reliably, and in such selection as is fitted for his level of understanding and his needs.

Since in the early 17th century this function of information was realized, its mastery has been a pressing problem for mankind. In 1613, Barnaby Rich said: "One of the diseases of this age is the multiplicity of books; they doth so overcharge the world that it is not able to digest the abundance of idle matter that is every day hatched and brought forward into the world" - yes, in 1613!

And already more than 200 years ago Gottfried Wilhelm Leibniz was complaining about the amount of new publications to be found at every Frankfurt Book Fair, "whereby all sciences are so snowed under that one scarcely knows why one needs such quantities and where one is to look for the individual pieces of information." That is why, in a petition he submitted in 1668 to Emperor Leopold I, he proposed an abstracting journal with these words:

"It is not enough to reproduce the names of the authors and the titles of the books, but it will be necessary to give a short extract of the points of emphasis, the contents and the highlights of each book, so that each publication will be accompanied by, say, a - handwritten - page." It took 160 years before, with the "Chemisches Zentralblatt. Vollständiges Repertorium für alle Zweige der reinen und angewandten Chemie", the first abstracting journal appeared - in 1830 in Weinheim. This was printed information processing - thus, documentation.

In 1874, at the very same time as Melvil Dewey was devising in Boston his Decimal Classification, John William Strutt, better known as Lord Rayleigh, was advertising Todhunter's "History of the Mathematical Theories" in "The Academy". I quote: "Scientific men must often experience a feeling not far removed from alarm, when we contemplate the flood of new knowledge which each year brings with it. New societies spring into existence, with their Proceedings and Transactions, laden with the latest discoveries, and new journals continually appear in response to the growing demand for popular science. Every year, the additions to the common stock of knowledge become more bulky, if not more valuable; and one is impelled to ask: where is this to end? Most students of science who desire something more than a general knowledge, feel that their powers of acquisition and retention are already severely taxed. It would seem that any considerable addition to the burden of existing information would make it almost intolerable."

Such was the situation in which the Institut International de Bibliographie was founded - as a link in a long chain. I would like, in all modesty, to emphasize. Paul Otlet and La Fontaine did not discover the significance of information and the problem of the information crisis of which I could give a few examples to my respected audience. Yet they did three decisive things which influenced in turn, in the chain of tradition, everything which has since been accomplished in national and international documentation.

The first was the human performance. They did not complain about the information crisis, but attacked it by applying their working-power and even their fortune. Sustained by a fanatical belief in the oneness of knowledge, and inspired by an idealism that allowed them to abandon their assured juristic positions, for four long decades they served the aims of documentation. The idealism they radiated has been conspicuous down to the present day.

These two men, lacking almost any support from outside, addressed themselves to the task of organizing world knowledge by bringing everything that had been devised, explored, discovered and invented by mankind in thousands of years into a classified central card catalogue, the Repertoire bibliographique universel, the R. B. U. In 1914, twenty years after they had started, the R. B. U. consisted of more than eleven million handwritten cards.

Apart from the Registre bibliographique universel, the following were kept:

Main Catalogue of Libraries (list of the then existing locations of works, books, and periodicals in the most important national and special libraries publishing their catalogue).

Main Register of Associations and Institutes (list of the names and addresses in all countries and covering all areas).

General Register for Iconography (collection of photographic documents on all subjects from various sources - approximately 150,000 cards).

These three tasks show more clearly than the R. B. U. and the UDC how utopian were the aims when related to available finances and manpower.

Does this matter? Has not just the failure of the R. B. U. meant the commencement of information awareness in science and economy (but unfortunately not yet in Governments)? The unfinished R. B. U. resulted in a shock, a constant reproach upon those who were made responsible for neglecting mankind's intellectual heritage, and thus the foundations of progress, and were also therefore responsible for inflicting immeasurable material damage. Only now was realized the magnitude of the taks were confronting those who tried to collect and document the available information. At this early stage, it was felt that titles are not sufficient for giving evidence, and that lists of titles often frighten off, instead of gladden the heart of, the persons seeking information; for already as the start was made on the R. B. U. there were 12,000 publications about the Maid of Orleans and more than 20,000 about Goethe or Shakespeare.

The need to facilitate access to the contents became clear, but also as a prerequisite to this access, that the contents were revealed and opened up through classification notations, descriptors, keywords or other indicators. Seen from this aspect it will be plain from what points of view Otlet and La Fontaine developed Dewey's Decimal Classification - which was a means for arranging books according to titles - into the UDC - a tool for classifying documents. Thomas Carlyle once said: "All that mankind has done, thought, gained or been, is lying in magic preservation in the pages of books." At no time was this apposite, because a large part of knowledge was always in manuscript. The Director-General of the French Archives - to give this example - is administering one thousand kilometres of priceless archival sources. Nevertheless, only now was it realized that, for documentation, every periodical article, every excursus in a bibliographical unit, is an independent document, and one which fre-

quently has to undergo still more extensive subdivision. Now already was considered the problem of the Tower of Babel, even if, because of the political changes brought about by the two World Wars, it has received an importance not yet foreseeable in 1895.

It is in the enormous stimulation aroused by Paul Otlet and Henri La Fontaine that I perceive their first great merit, and it is entirely immaterial whether this stimulation met with admiration or criticism.

There is one more element about which I should not be silent. For Otlet and La Fontaine, the worldwide bibliography was the cornerstone of international peace. La Fontaine, from 1894 to 1936 member of the Belgian Senate, occupied himself with peace research since 1889. It gives us a proud feeling that in 1913 the Nobel Peace Prize was awarded to one of the founders of FID (and, I may add, one of the grandfathers of UNESCO. La Fontaine, as Belgian delegate to the League of Nations, there introduced the Resolution "asking the Council how far it may be possible to organize the intellectual work of the world". This resolution led to the establishment by the League of a Committee on Intellectual Co-operation, which very justly is considered as the immediate forerunner of UNESCO). Has not the task remained the same for all of us: to contribute to peace by organizing the intellectual wealth of the world?

The key to this - and here lies the second lasting contribution of Otlet and La Fontaine - was the Universal Decimal Classification. May I quote from Otlet: "On the day on which the universal systematic arrangement has been circulated and has secured general application ... the public, with the aid of a single key - i.e., one and the same subject arrangement table - will be able to turn to account the wealth abounding in all collections of documents."

UDC is - to quote from A. F. C. Pollard - "no less than a method for expressing notions of the mind in figures, which are independent of language, understood by all, and have a definite and easily found position in any collection of material, however great." The introduction by Ltlet and La Fontaine of an auxiliary apparatus of connection and related signs, "lacking in the original Dewey system, has made UDC really universal", can be read in the BSI edition of UDC. Again Pollard: "The signs and auxiliary numbers, by association with the simple decimal numbers, convert the ... Dewey system into a powerful tool of bibliographical research worthy of universal recognition."

In starting this section with quotations, it was not my intention to hide my personal feelings. If the events of the Second World War, and still more those of the First, had not paralyzed the IIB and its successors, if what had been started in 1894 with such energy had been continued up to 1945 with the same impact as is now taking place for the Basic Medium Edition and through the activity of 24 UDC Revision Committees, then UDC would have met with the universal recognition of which Pollard speaks. Although it is now, by far, the world's most frequently used ordering system, and has even been officially introduced in many countries or is recognized as a standard, it is not being used as a universal ordering system by extremely important programmes, networks and systems. I point to "universal system"; here I do not indulge in any argument about the value of special classifications or of thesauri, which are limited to specific subject fields. All those engaged in the information field, whether they use the UDC or not, owe to Otlet and La Fontaine the insight that with the increasing size of the documentation their dependence upon the quality of the ordering system is increasing too.

The ideas to which, in many publications, Otlet gave expression are based on those of the Encyclopedists, of Diderot and d'Alembert, Chambers and Buffon; perhaps even more so on those of Dalgarno and Bishop Wilkins. Consequently, UDC was planned from the outset as an international language, as an international documentary encoding device which again is the realization of an idea of Gottfried Wilhelm Leibniz. Leibniz aimed at replacing at least in the domain of science, the national languages which had come to the fore after the decline of Latin and now caused communication difficulties, by an originally structured language. Again may I quote: "Learned men have long since thought of some kind of language or universal characteristic by which all concepts and things can be put into beautiful order, and with whose help different nations might communicate their thoughts and each read in his own language what another has written in his. No one has attempted a language or characteristic which includes at once both the arts of discovery and of judgment, that is, one whose signs or characters serve the same purpose that arithmetic signs serve for numbers and algebraic signs for quantities taken abstractly."

With this aspect of the UDC as an international language we have already reached the third element for which we are indebted to Otlet and La Fountaine and which has proved in the long run to have the greatest effect - namely, internationalization. As a consequence of the International Conference for Bibliography in 1895, they initiated international co-operation in the information field.

Nor in the sector of bibliography was this any sudden lunge into an empty space. There were Jullien's proposals, Danjou's Scheme of Universal Bibliography, which he had published in 1880 in the Library Journal, and, more regionally restricted, the "Project for a General Catalogue of French Libraries", printed in the Revue bleue precisely in time for the conference in August 1894.

This mention of the forerunners cannot belittle the achievement on which we are trying to attach the right value. Otlet and La Fontaine did not merely plan: they also put into practice. They did something which has always particularly impressed me: when they had recognized the Utopia and it had become clear to them that they could not even keep pace with the new publications, let alone incorporate into the R.B.U. what had already appeared, they did not give up. They were firmly convinced that the force of the idea to make man's knowledge accessible to all in need of it would sooner or later inspire a wave of co-operation all round the world and stimulate Governments to create, at national level, the preliminary conditions essential to success. Nor was this false reasoning: the International Conference for Bibliography and the resultant IIB, which for the first time allowed international co-operation in documentation to become a fact, was comprehended as a signal, and the UDC has evoked a wave of enthusiasm. In 1914, shortly before the war brought the operations to a standstill, the IIB had some 700 collaborators from many different nations. It was private persons with idealism, far ahead of their times, but unable to mobilize any financial support in their countries. Otlet recognized the situation: from 1908 he strove, if unsuccessfully, for the establishment of a "documentary Federation of Governments". It is a tragedy of a singular kind that Otlet and La Fontaine died only very shortly before UNESCO - together with many GOs and NGOs, and moreover with the ever more active participation of the Governments - made their vision become a reality.

Let us be cautious, even in our admiration. Is what is now being put into practice the dream of Otlet and La Fontaine? Certainly not the R.B.U., that central register of titles of the world knowledge in a single place. But the change to regional

or national systems and those determined by subject fields signifies no difference in principle. This decentralization reflects the fact that organized knowledge is no longer the primacy of the Occident and the other fact, that since the initiation of the R. B. U., the output of documents - first more slowly and then more quickly - has, on average, doubled every twelve years; where then it was 5,000 documents a year, it is now 500,000. No difference on principle in the idea, I said; as early as 1924, IIB was taking account of the changed situation with the transformation into a Federation of National Members. No change on principle in the tool, whether it be UDC, another classification or a thesaurus; and certainly no difference in the method, which even in the early literature was called "la methode documentaire". "Supported by an integrated and timely documentation", wrote Otlet in 1907 (which referred to libraries and archives), "helped by instruments of research (bibliographies), exercised according to rational and reflective processes (criticism of sources), the documentary method permits truly the collaborative assistance of all who have worked previously on the same questions".

And one year later, when La Fontaine and Otlet published their famous article in the IIB Bulletin 1908 they write: "The word 'documentation' expresses a fun ion such as that which must satisfy scientific and technical writing. Transformations may occur in the book, or modifications may occur in the internal arrangment of organizations charged with its conservation and distribution. That which is most important, that which remains permanently, is the necessity for rapid, complete, up-to-date information ... that is the need for documentation."

The necessity for rapid, complete, up-to-date information! In 1975 I would change only one word, and this may reflect the change we have undergone: the complete information has become a nightmare; our dream today is to have it well-selected.

Does this refraining to what is surveyable signify a resignation to universality? Today, universality is more important than ever, because specialization involves the danger that the fluid boundaries between the individual disciplines can become unsurmountable barriers. That would mean the end of human progress, which can continue only if there is an unimpeded flow of information between all specialized fields of knowledge.

In order to guarantee to all users the same opportunities, the final aim must therefore be a Universal Control of Knowledge, which again is based on a Universal Control of Contents. This does not signify an administrative measure. Universal Control of Knowledge means the full use of all possibilities inherent to documentation for finding ways and means of organizing the elements of knowledge in whatever sector of human activities, and, following the most careful selection, of making them available to all those who need to know them. Knowledge therefore is not restricted to scientific knowledge or to research findings. It is the sum total of the individual items of knowledge that, when they are transformed into reliable information, make it possible to work in any field more soundly, more expeditiously, more economically, and with greater profitability. These criteria already have the aspect of quality control as an essential feature.

FID is firmly convinced that the Universal Control of Knowledge is an obligation which is a direct consequence of the establishment of the Institut International de Bibliographie eighty years ago and of the development which has since taken place in all branches of the information sciences. FID does not pretend, however, to solve this great problem alone. We know that this can succeed only in international co-operation.

At this place you will certainly expect me to say a word about the present form of this co-operation, above all about the governmental organizations' relationship with the non governmental. For decades, FID has been urging Governments to become information-minded. Today, among those who are responsible in most Governments it has become a commonplace that documentation can with a minimum of cost contribute a maximum to national wealth. Should we complain that Governments are doing what we have called upon them to do? Certainly not. Nor should we be surprised if Governments turn to governmental organizations for their information needs. I would even consider this a normal consequence.

What is still unbalanced is the idea that information tasks have to be carried out by Government officials or their colleagues in GOs whereby the stream of resources develops into a road between Governments and GOs only. I call this an unbalanced situation because governmental information-awareness is something so new, and suddenly the usefulness of documentation for State and Government has become so striking that Governments are inclined to take into their own hands the entire set of problems as well as the solutions. That in the information field a sound balance has still to be reached becomes obvious when we compare the not-less-important contributions to national wealth made by, say, chemistry or mining or electrotechnics. Nobody ever dreams of having the work of chemists or miners done in government officers or having only GOs alimented for supranational problems and needs. I feel confident that in the future this sound balance between the important information tasks of governmental organizations and the equally important tasks of NGOs will be achieved.

Ladies and Gentlemen, our retrospective view has been focussed on the Institut International de Bibliographie and its founders, Henri La Fontaine and Paul Otlet. It has been my task to portrary how very much we are indebted to both, and not only historically. Many of their ideas still constitute the fundamental principles governing the work of documentation in the world. I have no thought of laying claim to these fruitful ideas solely for FID, whose General Secretaries Otlet and La Fontaine were up to 1931. Nor have I the intention to contrive a public relations effect for FID in indicating what new ways FID is pursuing and what FID has added to the original heritage handed down by our two founders.

Anybody concerning himself more closely with the IIB will be cautious in employing the attribute "original". As within the compass of this address I cannot be exhaustive, allow me to make one further brief allusion. As early as 1906, Paul Otlet published jointly with Robert Goldschmidt a small brochure on "The Microphotographic Book - a New Form of the Book". And that is, in all details, the micropublishing which in these days we are extolling as a wholly modern achievement.

From this, you will not draw the conclusion that nothing has changed since Otlet and La Fontaine. The greatest change is clearly evident in this room. Otlet and La Fontaine established the first international structure for documentation, libraries and archives. Referring to them I could, without hesitation, speak about bibliographies or archival matters, because it still took decades before IFLA and ICA made their appearance, or before UNESCO, FAO, IAEA or ILO, before OECD and CMEA existed. Do they mean a competition for FID, or a menace to the heritage of Otlet and La Fontaine? Not at all; on the contrary: the fulfilment of their dream. Allow me to conclude with something Catherine O'Murra once said: "Paul Otlet and Henri La Fontaine created a lasting, spiritual background for the present international organization of documentation." FID, in friendly co-operation with all governmental and non-governmental organizations, is proud to follow their noble traditions.

Thank you for your kind attention.

PAPER A. 2

THE FIRST EIGHTY YEARS OF FID AND INDIA'S PARTICIPATION IN ITS ACTIVITIES — A HISTORICAL PERSPECTIVE

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The history of the International Federation for Documentation has been told and retold by many experts on different occasions. The outlines of this history are fairly well known to all. Even then each account usually offers something new, something fresh and there is no abatement in the attempts to narrate this history again and again from different points of view and with different emphasis. Apparently, the history of the FID will never become old.

In 1975 this great institution completes the first eighty years of its useful existence. Surely, this is an appropriate occasion to review once again the objectives and ideals for which the FID has stood and the stress and strain of time through which it had to pass and the tremendous versatility it had exhibited in many of its changes. Boyd Rayward in one of the brilliant reviews has said, "... the history of the organization is a sequence of expansions and contractions, of structural adjustments by which, despite two world wars, a long period of English indifference, and American suspicion, it was able to survive as an important international bibliographic force" [2]. The same source also mentions , as important issues, the nature and extent of FID's dependence on the energies and finances of individuals such as the founding fathers and also its relations with the then international organisations. To begin with, some of these points and issues may be taken up for discussion.

FID considers 1895 as the official year of its foundation although preliminary work started earlier. The first meeting in 1892, of the two founding fathers Paul Otlet and Henri La Fontaine, at rue de Florence, blossomed into a life-long bibliographical partnership. It is providential that bibliography brought these two jurists together. It was again bibliography that changed the course of life of both the two pioneers and they in turn were destined to change and guide the course of bibliography for nearly the next fifty years.

Some preliminary bibliographical works in the Social Sciences by Otlet and La Fontaine since 1892 convinced them of the need for comprehensive subject indexes. It is said that more than the actual work in the bibliographical field, their 'intuition saw the problem and also the key to its solution'. They were convinced, so far as the solution was concerned, that subject indexes were essential and to prepare universal subject index international co-operation was essential. The intial spade work of the founding fathers was entirely devoted towards the realisation of these objectives. They were successful in calling an international conference in Brussels on 2-4 September 1895. This conference gave birth to the Institut International de Bibliographic (IIB).

With this sprang up another establishment, namely, the Office International de Bibliographic (OIB) whose objective was to organise, publish and maintain a bibliographical World Catalogue, or the Repertoire Bibliographique Universal (RBU).

Both, in the compilation of the RBU, that immense dinosaurian card catalogue, and also in the organisation of bibliography internationally, the need for a device or mechanism which could 'combine organically by means of graphic marks all things that deal with one subject, one thought, one thing, or one impression, regardless whether these be books, pictures, or musical scores' was felt. This is how the search for a good scheme of classification started. Otlet and La Fontaine had heard about Melvil Dewey's Decimal Classification (D.C.). It would be quite queer reading for us, who are going to celebrate next year the centenary of publication of this scheme of classification, now used throughout the world, that it was quite difficult at that time to get a copy of D C in Europe. A copy had to be brought all the way from the U.S.A.

This precious copy of the DC was used for the classification of index entries, the 'classification marathan' of 400,000 entries in less than two months time. The adaptation of DC, and finally the publication of the Universal Decimal Classification (UDC) in 1905 are all too well known to need any repitition here.

All accounts of the formative years of the FID, or the IIB as it was known then, usually draw our attention to one point again and again. It is the Institute's intimate relation with a scheme of classification, that is the UDC. Looking at it now, from such a distance in time, it appears that the IIB attached undue importance to the development of the UDC, which was after all going to be just a device or a mechanism for organising bibliography. This lopsidedness is all the more apparent when we remember that the compilation and maintenance of the Repertoire Bibliographique, for which the UDC was primarily going to be used, was actually a responsibility of the OIB, a different establishment altogether than the IIB. However, one has to remember also that one of the founding fathers, namely, Otlet was involved with both the establishments.

It is only in recent years that some experts have started probing into the alleged preoccupation of the IIB with UDC. It is quite a curious thing to observe that some people have complained that it is primarily due to its preoccupation with the UDC, that the IIB did not become a truly world organisation. Aloofness of the USA from active participation in the affairs of IIB for a long time was ascribed to this. At the same time the pioneers believed that UDC was to contribute most significantly to the realisation of a world bibliography with international cooperation. It was even thought that the UDC was the most important 'intellectual attribute' of the IIB.

Impartial study would certainly establish that on final analysis the UDC and the RBUwere both characteristics of their times. They precipitated from their immediate historical context. The concept of universal bibliography was still alive in Europe. However, there was some changes in the concept since the days of Konrad Gesner. The emphasis had shifted from books to much more prolific items of information, that is, articles in periodicals and from printed volumes of bibliography to card index. This was evident in the Royal Society's Catalogue of Scientific Papers and similar ventures. Hence, the RBU as a 'hydra-headed bibliographic monster' had quite an easy acceptance in the then bibliographic world of Europe.

To Otlet and La Fontaine the RBU and the UDC were so much inter-related and integrated that they could not think of any one without the other. They had imagined

the RBU as providing the 'rallying point for documentary work anywhere', and the UDC as presenting a 'general scientific tool for achievement of the much desired internationalisation of methods and general standardisation of results'. It is said that in UDC, one is able to find even a happy blend of ideas from encyclopedists, philosophers, and linguists for the organisation of knowledge. Otlet must have seen 'in his mind's eye a great, dynamic, global encyclopaedia, with tributary streams flowing into it and swelling it from every country in the world'. Without an international language like the UDC and a device to combine organically through notations all things that deal with one subject or one thought such global encyclopaedia was not possible.

Recently, Professor H Arntz has drawn our attention to one aspect which provides a new point of view to IIB's attitude towards classification. He says, "it is significant that FID has never attempted to return to the year 1876 and Mebril Dewey's classification, since Dewey created a means for systematic arrangement in libraries, whereas Otlet and La Fontaine transformed the means into the instrument of documentation" [1]. This observation is quite significant when we compare this aspect of the work of the IIB with that of the International Catalogue of Scientific Literature. It may be recalled that in the same year as the IIB's foundation, that is 1895, another international conference was held in London to discuss and make the final arrangements for the launching of the ambitious International Catalogue which was to record the literature of the 20th century. At this conference considerable attention was given to the question of using a scheme of classification. Finally, it was decided to devise a new scheme for the Catalogue. Thus they preferred to go back to the days of Dewey. But the story at Brussels was quite different. It was decided to adopt and modify Dewey's Classification and this happened in spite of the fact that many of the delegates were actually common at the London and Brussels conferences. That this was a decision of immense consequence is borne out by the simple fact that the classification scheme of the Catalogue died with it but the UDC is very much alive to-day, long after the discontinuation of the RBU. UDC is surely the most well-known and permanent contribution of FID.

The above may appear more as a history of UDC. But this is inseparable from the history of the IIB. As has been said, "At the outset the UDC was the instrument and later for decades the activity of the FID". One more aspect of the activities of the IIB need be mentioned here. Otlet could realise the possibilities of the microfilm in libraries. He even designed a small reading apparatus and drew the attention of librarians to its use through a paper published as early as 1906.

It is extremely unfortunate that the IIB had to face the devastating World War I within the first 20 years of its foundation. Like many other institutions and ideas of international cooperation the IIB also suffered losses. After the cessation of hostilities when the time came for dusting off plans and proposals and start work again, it was found that the bibliographical world itself had changed considerably and with it the attitudes and ideas about bibliographical control had also started changing. It appears that for the IIB this shaking-off time was a little longer. However, the decade from 1920 to 1930 was mainly a period of rethinking. There were hardly any other activities of significance. The beginning of the decade was marked by the IIB Congress at Brussels in 1920 and it culminated with the changing of the name of IIB to Institut International de Documentation (IID) in 1931.

The above change was not just trifling with names, it was of profound significance. This was a clear indication of the passing away of the old order of bibliography giving place to the new concept which was 'more extended in its purpose, more realistic and dynamic in outlook, and more rapid in its advance' which came to be

designated as documentation. This very important change in the course of the Institute was brought about deliberately and correctly by its founding fathers during those eventful years in the eddies of which many were caught distressingly floundering. Only they were able to rise much above and see bibliography in its total and changing form. The effect of the devastating war is clearly indicated by the fact that as efforts were going on in Brussels for the reorganisation of the IIB, the sponsors of the International Catalogue of Scientific Literature decided in London to abandon the project.

Even though the IIB was changed to IID in 1931 and assumed a new character, it appears from all accounts that it could not take up or carry through any programme of great significance. Financially, the Institute was in a very bad shape. At one point, perhaps in desperation, financial aid from the American Library Association was saught which it did not receive. It is significant that the idea of developing national centres which could pool their bibliographical contributions towards international bibliographical activities and could also act as bulwark and keep on the activities at least at the national level in times of belligerent events, was first mooted out in the thirties. Surely, this was a pertinent lesson that was learnt as a consequence of the events of the First World War. This was true not only for international bibliographical cooperation but possibly for any type of intellectual cooperation. However, this new idea required considerable time, preparation and cooperation from various agencies for its implementation.

The next turning point in the history of the Brussels Institute came in 1938 when the first step towards the realisation of the new order to national centres as dependable base for international cooperation was taken. To mark the beginning of this new order the name of the Institute was significantly changed to Federation Internationale de Documentation or the FID. This was a'deliberate renunciation of the centralistic institute' and an attempt to strike a balance between nationalism and internationalism. One immediate response to this change was that the American Library Association became an associate member of the FID in 1939. However, the Second World War broke out with much more devastating effects to paralyse all activities of international cooperation till 1945. During this dark period the founding fathers, whose energy and vision had guided the course of FID for so long like a lodestar, departed from the scene for ever. La Fontaine died in 1943 and his life-long bibliographical partner in 1944.

After 1945, with the cessation of hostilities, a new era of intellectual cooperation began. Government began to show more interest in documentation. But, alas the FID was not prepared to take full advantage of this situation. Professor Arntz has pointed out in no uncertain words the unfortunate inaction and aloofness of FID during this period. A number of agencies of the United Nations and other international agencies were now aware of the importance of documentation. A number of governments were now prepared to spend on documentation activities for preparing the proper infrastructure for the various reconstruction and developmental programmes of their respective war devastated countries. Conditions were just ripe to sell documentation. This opportunity was missed by the FID, otherwise its history would have been different.

Documentation was necessary for after-war reconstruction work but before that reconstruction and some rethinking were necessary in the highest institution of documentation itself. This, however, came around 1950 only. The message of FID started spreading beyond Europe and within Europe to countries which were completely aloof so far. Membership of three Asian countries, namely, Indonesia, Japan, and India in 1950, 1951, and 1952 respectively marked this period of expansion. The member-

ship rose to 30 in 1960 from only 7 in 1938. The venues of the conferences also shifted to new places, such as Belgrade (1954), Washington (1958), Rio de Janeiro (1960) and so on.

The expansion of FID membership to more countries, especially non-European countries, helped the FID in an indirect way, in its own reorganisation. As the membership spread to more heterogenous groups, it was soon revealed that more and more member states were not satisfied with the plans and programmes of the FID. This dissatisfaction set into motion talks of reorganisation. A complete plan was prepared in 1958 and was presented at the Warsaw conference in 1959. Finally, the plan was published in January 1960 as the 'Outline of a long-term policy' (publ. 325). This can be considered as the new charter of the FID.

In the Introduction to the new charter of 1960, a realisation of the increasing responsibility of the FID is clearly stated. It says, "For a number of years it has become ever more evident that the FID must alter and strengthen its activities if it is to be the leading organisation of international documentation in a rapidly changing world... scientific documentation has developed rapidly and its use recognised in every field of intellectual and economic endeavour. The rapid extension of knowledge and the speed with which it is applied, demand however the development of still more effective techniques and systems of documentation to provide order and accessibility. These are matters which require consideration and action on an international level and clearly the Federation has a major part to play".

The major areas for consideration were also analysed and the tasks stated in the above publication. They have been constantly under study mainly through the various study committees of the FID most of which were constituted after 1950 and quite a few constituted or reconstituted after 1960.

The aim of FID was also sufficiently broadend at the same time and formulated as "to promote through international co-operation, research in and development of documentation which includes, inter alia, the organisation, storage, retrieval, dissemination and evaluation of information however recorded, in the fields of science, technology, social sciences, árts and humanities".

The 1960 policy formulation was a clear analysis of the then prevailing situation and it incidentally showed also the wide gap between what was required to be done and what the FID was doing. The areas of activities that were mentioned were to many. It was not possible for the FID to initiate action in all those areas. Hence, it was necessary to determine priorities and formulate specific programmes keeping in view the financial and organisational capabilities of the FID. This was done in two stages – first, through the publication of the 'Statement on a New FID Programme to Meet Changing Information Patterns' in 1966, and then through a new programme approved at the General Assembly in 1970. The present programme covers generally the following fields:

1. Theoretical studies and research in documentation, librarianship and information science, terminology, applied linguistics, mechanisation, information networks, and classification;
2. Updating the Universal Decimal Classification;
3. Guides to information sources;
4. Information for industry;
5. Organisation of documentation in developing countries; and
6. Training of documentalists and education of users of information.

That brings us to the present period of FID's history. The aims and activities of this international organisation are all before us. One significant aspect of the present era is FID's increasing collaboration with other international organisations interested in documentation. FID has consultative relations with eleven other international organisations and is an affiliate of the ICSU. It is also a member of five other international agencies. The motivation clearly is 'not to loose contact with reality' again, as it did in 1940s. The international character of the FID is also revealed by the fact that it has now 62 national members, 3 international members and more than 350 affiliates, which includes 16 international organisations, 179 institutions, 14 countries not having the status of national member, and a large number of individuals. Out of the 62 national members, 16 are from Asia and Oceania, 7 from Africa, 24 from Europe, and the remaining 15 from the Americas.

It would be surely appropriate here to review briefly India's participation in FID's activities. It has been mentioned earlier that FID's activities were largely concentrated in Europe. The national membership was stagnant for quite some time and restricted to the five founding members. It is only after 1938 the membership started increasing slowly. In those days the only way to express faith or take part in FID's activities was to adopt the UDC. On UDC depended the strength of FID. It is not known where and when exactly the UDC was first adopted in India for bibliographical work. But is is known that in some of the early bibliographical ventures, like the Irrigation Abstracts which started in 1936, UDC was used. The Indian Agricultural Research Institute was a very early user of the UDC. Paul Otlet had once called such agencies and services as 'amis inconnus', that is unknown friends. A few scientific periodicals also started the UDC for classifying the individual contributions published in them. The Journal of the Institution of Engineers (India) and the Journal of Meteorology and Geophysics are two important examples. Surely, Otlet's vision of 'tributory streams flowing into it and swelling it from every country in the world' was partially realised in such a practice.

India became a national member of FID in 1952. But even before that a unique link was established. Dr. S.R. Ranganathan was made the Rapporteur-General of the FID/CA Committee on General theory of Classification (now reconstituted as the FID/CR). It may be recalled that this was one of the earliest Study Committee. In 1960 the Secretariat of the FID/CA was assigned to India. The FID/CA Reports that were produced from India by Dr. Ranganathan are considered to be the most authentic reports on the development of classificatory ideas. They have influenced all schemes of calssifications in some way. The last report by him (FID/CR Report no. 12), published posthumously in 1972, was released as the Ranganathan Memorial issue. Dr. Ranganathan was elected Vice-President in 1953 and was also in the editorial committee of the Revue de la Documentation. He was elected as an Honorary Fellow, a distinction conferred on a few only, and only one from this part of the world.

It is well known that INSDOC has been representing India as the National Member of FID since 1952. One aspect is, perhaps, not so well known that in the establishment of INSDOC, the FID took some part. As early as November 1946, the FID invoked the good offices of the ISO to stimulate the formation of a national documentation committee in each country. This was communicated by ISO to the Indian Standards Institution in May 1947. About the same time the FID directly approached Dr. Ranganathan on this matter. All these culminated in the establishment of INSDOC in 1952 through the technical assistance of the Unesco.

India is now a member of the FID Council also. The Secretariat of the FID/CR has come back to India after a short period of gap. India is also a member of the FID/II (Information for Industry) Study Committee, FID/DC (Developing Countries) Special Committee, FID/CAO (Committee on Asia and Oceania), and the Working Group FID/SRC — Subject-field Reference Code.

The year 1975 has been specially significant for us as it started with the holding of the Third International Study Conference on Classification Research at Bombay. It is gratifying that such a conference could be held in India, the homeland of Dr. Ranganathan, whose energies and devotion nourished the FID/CR for a long time. The theme of the Conference was Ordering Systems for Global Information Networks. That indicates the vastly expanded scope and interests of the FID/CR. It was evident from the Bombay Conference that this extended scope was largely responsible for bringing in different groups of people interested in documentation. Surely, this is in line with FID's policy of 'public confrontation' pursued since the Warsaw Conference in 1958.

In a paper published in 1963, Dr Ranganathan had expressed his desire that the FID should come closer to Asia and Africa to become a really international organisation. He said, "At present, the FID continues to be virtually a Western organisation in spite of the intellectual appreciation on the part of some of its members of the need for making it international in fact. The encrustation, developed during the last half century is difficult to break. The inexorable, unconcious though it be, permeation of prestige would naturally seek to prop up and preserve that encrustation. It may take a decade or two for the research tempo of Asia and Africa to acquire the necessary intensity to cause the painless dropping out of this encrustation." [6]

It may be said now that the above wish has come true. FID is now a truly international organisation. So far as India is concerned the formation of a very representative National Committee for FID in 1974 is a clear evidence of its faith and support in the aims and ideals of the FID. The present Seminar organised by the National Committee to mark the 80th anniversary of FID will surely be considered an important event. Let us hope that India will be able to take more active part in the programmes and activities of the FID in the coming years .

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PAPER B-1

INFORMATION SYSTEM FOR RESEARCH AND DEVELOPMENT IN INDIA

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1 *The Industrial Scene in India*

The Research & Development (R & D) activity is the life blood for a country's industrial development leading to its economic advancement. For India the need for R & D activity has never been so vital and great as it is to-day. Prior to India's achieving independence there was very little industrial development in the country because the British Government being not interested in the industrialisation of the country, offered little incentive and encouragement for that purpose. Rather the British Government wanted India to be the export market for the goods manufactured in U.K. Whatever industrialisation took place in India, prior to the attainment of independence, it was mainly due to the individual initiative, zeal and efforts of a few industrialists who had an inborn urge for adventure in the field of industrialisation and they established the industry in India against heavy odds.

After the attainment of independence, with a truely national Government in power, the country embarked upon industrialisation. Since the Indian industrialists had no much experience in this field and not being willing to go in for an industrial adventure, they took the most safe and secure course of relying upon the experience of foreign industrialists and went in for foreign collaboration in establishing the industry in India. There was nothing unusual in that but something quite natural. This act of going in for foreign collaboration by the Indian industrialists may be compared to that of a child, while learning to walk, to catch hold the hand of an adult for the purpose. As is well known the child does so till he overcomes his initial nervousness and builds up his own potential, strength and confidence to toddle about alone and then slowly perfects his walking by himself. It appears that the phase of the Indian industry going in for foreign collaboration is fast coming to an end as it has been able to overcome its initial diffidence. During the post-independence era the Indian industry has dug in its sound foundation and has reached the take-off stage. For its further development it needs to be fed constantly with new inventions which are so essential for its survival and development.

A vast amount of scientific and technical knowledge has accumulated in the two centuries since the beginning of the industrial revolution. This technological knowledge has been beneficially utilized in the industrialized countries to raise the living

standard of their people. The income per head in these countries is now atleast 10 times than that in the developing countries where about three fourths of the world population lives. This state of affairs in the developing countries is mainly due to their isolation from the technological developments utilized by the developed countries, for their economic advancement. Easy access to technological knowledge and its selective and proper utilization is the key to raising the living standard of the people in the developing countries.

One important factor responsible for the limited utilization within developing countries of the existing technological knowledge is the lack of essential information in the developing countries about this technological knowledge available in the industrialized countries. Geographical frontiers which once stood as obstacles in the flow of technology from one country to another have started crumbling and the developing countries have comparatively an easier access to the technological advances being made in the industrialized countries. It is now universally acknowledged that technical information is as vital a tool as finances, equipment etc. not only for the industrial development but also for those engaged in research work. Since the developing countries are embarking upon industrialisation to improve their economic condition, it is imperative to build up an information system to feed the industry and those engaged in research work with information about the latest technological developments being innovated in the industrialized countries.

2 *Need of Information about Technological Developments.*

With a view to survive the ever-existing challenge from the rivals in the trade, the industry has to constantly strive either to improve upon its products or to cut down its cost of manufacture or to develop new products. For that purpose the industry has to be constantly fed with new inventions. This need of new inventions could be met in two ways:

(a) From industry's own R & D activity.

This R & D activity is a very important and useful source to meet the industry's requirements by studying the defects and shortcomings in the existing processes, machinery and equipment being used by the industry and to find out ways and means to obviate these defects with a view either to improve upon its existing products or to cut down their cost of manufacture or to develop new products and has the added advantage of meeting the requirements in a tailor-made fashion. It is only through its own R & D activity that an industry generates its own potential. Without it the industry would get into stagnation in no time and ultimately would be run over by its rivals in the trade.

(b) From outside sources.

For obtaining new inventions from outside sources the information about new inventions in respect of the latest technological advances made in that particular field of technology throughout the world must be made available to the industry to enable it to select suitable and useful inventions and take necessary steps towards their utilization for its development.

The information about the latest scientific and technical developments is also very useful to the research workers in the following ways:-

i) It would enable the research workers in the country to know in what channels the research work is being done in the foreign countries. This information would be extremely useful in providing necessary guidelines to research workers in the country.

ii) It would enable to avoid duplication of research work already done in other countries. In the absence of information about the latest scientific and technical advances being made in the various technological fields in foreign countries research workers in this country would be toiling and spending their energy, time and finances in research work which ultimately may turn out to be a mere duplication of that what has already been done abroad. Instances when research work done has turned out to be a mere duplication of what was already done in other countries are not lacking e.g.

a) Work done in a Scandinavian laboratory on the validity of Lambert's law relating to photometer was discovered to have already been done in Germany. Similarly work done on the design and development of a frequency multiplier for frequency modulated radiophony was found to be a mere duplication.

b) Research on electronic translation equipment carried out for 5 years in U.S.A. turned out to be mere duplication of work done in Russia.

c) A method developed for the dispersion of sulphur in ceramic batches in a Scandinavian laboratory was found to be a mere duplication of the work done by I.C.I., U.K.

d) U.S. Department of Defence Survey has reported that research work done for the development of advanced weapons and missile systems since World War II turned out to be a mere duplication of the work done 30 years earlier.

e) Work carried out in Australia on the Physics and Chemistry of boiling water in 1946 turned out to be mere duplication of the work done in Japan 12 years earlier.

Timely information about the research work being done in foreign countries would avoid duplication thereof and thus would save valuable man-hours and finances.

3 *Patents as Source of Technical Information.*

Of the various sources of information regarding the latest scientific and technical advances being made all over the world, a very important, useful and in a way unique source is the patents granted in the various countries throughout the world.

A patent, generally speaking, is a grant from the Govt. to an inventor of a new and useful invention or his assignee conferring on him for a limited period the exclusive privilege of using the patented invention and authorising others to do so in exchange of a full and detailed disclosure of his invention to the public. Publication of the detailed description of the patented invention is an essential function of the patent system. This publication is not limited to the country in which the patent is granted but is available to the whole world. This public disclosure adds to and extends the frontier of knowledge. This disclosure function of the patent system constitutes an essential component of modern systems of technological information.

The practical functions of the disclosure of the technical information contained in patents are:

(a) to supply the general public with a complete survey of the recent state of technological development;

(b) to provide the necessary information and stimulation for continuing developments on the basis of patented inventions; and

(c) to direct those interested in the exploitation of an invention to the relevant source of technology.

4 *Uniqueness.*

Patent as a source of technical information is unique for the following reasons:

i) In many cases it provides information about the latest inventions which has not yet been published in any technical book or journal.

It is an essential requirement of the patent law that an invention to be patented should not be published before an application for the grant of a patent therefor is filed in the Patent Office, otherwise it would prejudice its patentability. After an application for the grant of a patent is accepted by the patent office, the accompanying patent specification is published. In most of the cases this publication of the invention in the Patent specification is the first such publication because on account of pressure on space in technical books and journals the publication of a detail description of new inventions in books and journals takes considerable time.

ii) Information available in the patent specifications is much more detailed and exhaustive than that available in any technical book or journal.

It is a statutory requirement of the patent law in most of the countries that the description of the invention in the specification accompanying the application must be sufficiently clear and complete to permit others skilled in the art to use the invention. Some laws however, require in addition to this disclosure, the best method of putting the invention into practice. The Indian patent law is even more specific. It requires that the complete specification must fully and particularly describe the nature of the invention, its operation and use and the method by which it is to be performed and must also disclose the best method of performing the invention known to the applicant. The description of the invention in the complete specification is required to be sufficient to enable any person skilled in the art to which the invention relates to work the invention without any further assistance from the inventor. From that standpoint the applicant is required to give in his specification a detailed and exhaustive description of his invention supported by sufficient number of drawings and practical examples to fully illustrate his invention. There are at time quite voluminous patent specifications especially those relating to computers, calculating machines, telephone exchanges and the like. For example Indian patent No. 83788 relating to computers with error recovery covers 83 pages and 111 drawing sheets; Patent No. 101146 relating to Data Handling systems covers 25 pages and 74 drawing sheets; Patent No. 131715 relating to Business machines cover 25 pages and 23 drawing sheets; Patent No. 121164 relating to Phosphoric acid esters covers 81 pages and 19 drawing sheets; Patent No. 123916 relating to azo dyestuffs covers 18 pages and 138 drawing sheets. Surely in respect of a single invention these patent specifications contain much more detailed information than can be obtained in any technical book or journal. Publishers would certainly be reluctant to publish such detailed and exhaustive information in respect of a single invention in any technical book or journal.

A very familiar criticism against the sufficiency of the description of the invention in the Patents is that the technical information which is essential for the most efficient working of the patented invention generally called as "know-how" is not disclosed in the patent specification. It may be true in respect of some of the cases but not in all cases. Primarily it may not be due to any secretiveness or desire on the part of the applicant for patent to keep some details regarding his patented invention up his sleeves but possibly it may be so on account of the inevitable result of the "first to file" rule of the patent system. With a desire to get the earliest priority date, the application for patent is filed as soon as an invention is conceived and put in a working order. It is only after obtaining the patent or atleast after filing the application for patent, that the applicant applies his mind to work out the most economical method to carry out his invention on commercial scale either generally or under some particular local conditions. It is thus quite possible that the best method to work the invention economically and thus competitively commercially may not be known to the applicant at the time of making the application for patent. There is nothing to find fault with him if the applicant has disclosed all what he knew about his invention at the date of filing of the application. However even if some working details are missing in the patent specification, it does not completely negative the contribution the patentee has made to the storehouse of knowledge of the human society. The patentee may be quite willing to give this "know-how" to any person who obtains a licence to work his patented invention. Even otherwise this missing "know-how" may be worked out by any person interested even without the help of the patentee without much difficulty. It would certainly be comparatively much more convenient and less costly to work out a few essential missing details of the invention than to work out the invention as a whole.

iii) In some cases it is the only source of information. An application for the grant of patent is filed as soon as a new invention, having a <u>prima-facie</u> utility is made. Its actual usefulness and utility is in fact established only after it is commercially worked. As for the publication in technical books and journals is concerned, generally only those inventions which possess great commercial feasibility and utility, find place and others which do not fulfil this criteria are either completely ignored or dealt with in a passing reference manner. In the case of latter inventions the patent specification is the only source of detailed information in respect thereof.

iv) Information regarding all inventions in respect of any particular subject-matter is available very conveniently at one place under one classification 'Heading'.

The patents granted are classified according to their subject matter. A perusal of the patents so classified would give an exhaustive information about all the inventions patented in respect of that subject-matter in a very convenient manner. On the other hand information about any particular technical subject-matter may be scattered in various technical books and journals and thus may not be readily and conveniently accessible.

5 *Retrieval of Information from Patents.*

Retrieval of information contained in patents is needed by the potential applicants for the grant of Patents, patent issuing authorities, inventors, research workers and all those who are concerned with the application or development of technology. With a view to achieve quick and convenient retrieval of the information contained in patents, the Patents are classified according to their subject-matter. Each country has its own national classification system for the classification of patents. To bring about uni-

formity in the classification being done in the various countries a classification system known as International Patents Classification (IPC) has been developed based on Strasbourg Agreement which was concluded in March, 1971 within the framework of the Paris Convention For The Protection of Industrial Property. The IPC has been adopted by most of the countries. Classification according to IPC is considered to be more systematic, sufficiently exhaustive and precise and therefore retrieval of information from patents classified according to IPC would be comparatively much more convenient and less time consuming. In all such countries where IPC has been adopted, classification of patents is done both according to their national classification system as well as according to IPC.

According to IPC, the entire field of technology for which patents can be granted is classified into 8 Sections - Sections A to H namely

Section A - Human necessities.
Section B - Performing operations.
Section C - Chemistry and Metallurgy.
Section D - Textile and Paper.
Section E - Fixed Constructions.
Section F - Mechanics, Lighting and Heating.
Section G - Physics.
Section H - Electricity.

Each Section is further sub-divided into sub-sections, classes, Sub-classes, Main groups & sub-groups. Thus the IPC comprises 8 Sections, 115 classes, 607 sub-classes, 5885 Main groups and a total of 40325 Sub-groups. Each sub-group covers a very narrow and precise technological field making the retrieval of the information regarding the subject matter of the patents quick and convenient.

In addition to Patents, it is generally a standing practice with most of the Patent Offices in the world to prepare abstracts (called abridgements) of the inventions for which the patents are granted. These abridgements are also classified in the same manner in which the Patents are classified. The abridgements give a preliminary insight into the subject matter of the patents and a search through abridgements is much more convenient and less time consuming than that through patents.

6 *Patents Documentation and Information Centres.*

For providing an easy access to the technology covered by patents, various, countries have established Patents Documentation and Information Centres for documentation of Patents and dissemination of technical information contained therein such as The International Patent Documentation Centre, Vienna (INPADOC), The Japan Patent Information Centre (JAPATIC), The International Pateht Institute, The Hague (IIB), The GDR Information and Search Centre.

To make available to the industry and research workers in this country information about the latest advances being made in the various technological fields in the industrialized countries which are generally covered by patents, a Patent Information Centre (PIC) should be set up in India. The main objectives of PIC would be:

(a) To procure patents granted in some of the important industrialized countries of the world such as U.K. Federal Republic of Germany, German Democratic Re-

public, France, U.S.A., U.S.S.R. and Japan and also those granted in India. If and when the European Patents Convention comes into force, instead of patents granted in U.K. France, Federal Republic of Germany, German Democratic Republic, only the European Patents would be procured. This would cover practically all the important inventions made throughout the world because generally speaking all important and useful inventions are patented in one or more of the aforesaid industrialized countries.

(b) To provide a storehouse of latest technical information contained in Patents which in most of the cases might not have been published in any book or Journal before the publication of the Patent.

(c) To provide documentation service for patents to serve as a convenient means for retrieval of the information contained therein as and when needed.

(d) Be a clearing house for the scientific and technical information available from patents for dissemination to the industry and research workers in the country.

(e) Be a partner in the integrated development of the various documentation and/or information centres that may be set up in the country to meet the need of the industry and the research workers.

The main functions of the PIC would be:

Classification of patent

a) Classification of patents granted in Indian and the aforesaid foreign countries as well as their abridgements subject matter-wise according to IPC to provide for subject matter search through patents.

b) Preparation of industry-wise classification of aforesaid patents.

c) Preparation of the Name Index of the Patentees of the aforesaid patents to provide for Name-index search through patents.

d) To have a liaison with the industry and the research workers with a view to identify their requirements regarding technical information.

e) To make available for reference all the aforesaid classified patents and their abridgements to the public.

f) To supply the technical information contained in patents to industry and research workers in respect of any subject matter.

g) To prepare translation of patents which are in a language other than in English whenever necessary.

h) To supply reprographic copies of the patents or their abridgements to the public whenever required.

7 *Utilization of the Technical Information by Indian Industry.*

Through the documentation and dissemination service of the PIC, the informati about the latest developments in the various technological fields contained in patents would be made available to the Indian industry, which may beneficially be utilized by it in the following ways:

(a) If the invention which is desired to be worked by any Indian industry has been patented only in any foreign country and a corresponding patent for the same invention has not been obtained in India, the invention may be worked in India without payment of any royalty or remuneration to the patentee.

(b) In case the said invention has also been patented in India and the Indian patent is in force, the patentee may be approached for the grant of a licence to work the said invention on terms mutually agreeable to the parties.

(c) In case the patentee in respect of a patent granted in India is not willing to grant a licence or the terms thereof are not mutually agreeable between the parties, any person interested to work the patented invention may at any time after the expiration of three years from the date of the sealing of the patent, make an application to the Controller of patents for the grant of a compulsory licence to work the patented invention on the ground that the reasonable requirements of the public with respect to the patented invention have not been satisfied or that the patented invention is not available to the public, at a reasonable price. The Controller if satisfied on the ground relied upon may order the patentee to grant a licence upon such terms, as the Controller may deem fit.

(d) The Central Govt. have been empowered under Section 86 of the Patents Act, 1970 to apply to the Controller of Patents, at any time after the expiration of three years from the date of sealing of a patent granted in India for an order that the patent may be endorsed with the words "Licences of right" on the ground that the reasonable requirements of the public with respect to the patented invention have not been satisfied or that the patented invention is not available to the public at a reasonable price. Patents relating to substances intended for or capable of being used as food, medicines or drugs and chemical substances are automatically deemed to be so endorsed from the expiration of three years from the date of sealing of the patent without any application being filed by the Central Government to that effect. The effect of this endorsement is that a licence under the patent so endorsed may be obtained by making an application therefor to the Controller of Patents, more or less as a matter of right.

(e) A patent granted in India ceases to have effect either on the expiry of its prescribed term or if the prescribed renewal fees in respect thereof are not paid within the prescribed period. When a patent so ceases, the invention covered by the said patent becomes public property and may be worked by anybody without payment of any royalty or remuneration to the patentee.

The establishment of an Information Service for the documentation of the patents granted in the industrialized countries and the dissemination of the technological information contained therein to the industry and the research workers in the country would greatly contribute towards the industrial development and consequent economic advancement.

Paper B-2

DEVELOPMENT SCIENCE INFORMATION SYSTEM (DEVSIS):

Proposal for a Global Information System for Socio-Economic Development

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[DEVSIS is a proposal for an international information system in the field of economic and social development, co-sponsored by IDRC, ILO, OECD, UNDP, UNESCO, and the United Nations Department of Economic and Social Affairs. The system will be directed towards meeting the information needs of planners and policy-makers in the developing countries and the development research community. It will be built as far as possible on existing information infrastructures in the developing world and take advantage of the information processing capabilities already in place in international organizations. The proposal was endorsed by representatives of 28 national and international organizations at a meeting held in Ottawa in June 1974. The preliminary ideas on the overall objectives, the types of services envisaged, the categories of information to be admitted to the data base, and organization of DEVSIS are briefly outlined. The need for such a system, and the genesis of the proposal are also considered. Some of the features of DEVSIS are compared with those of INIS and AGRIS. The work of the DEVSIS Study Team and the thinking and actions preceding it, are viewed as an exercise in systems design and planning.]

Introduction

In March this year, a Study Team consisting of some half a dozen persons began work at the ILO, Geneva, on a feasibility study for a global information system for the socio-economic development field. The system is called Development Science Information System (DEVSIS). The Study Team was assisted, from time to time, by specialists on specific aspects of the design of the system. The first version of the complete report of the team has just been released. It will be discussed at the DEVSIS Steering Committee meeting in Paris, 4-5 Dec 1975 and at an evaluatory meeting in West Berlin, 8-12 Dec 1975. The work of the Study Team and the thinking and actions preceding it can be viewed as an exercise in systems design and planning.

The major parameters generally considered in a system design are:

1. Establishing need for the proposed system
2. Overall scope of the system to meet the identified needs.
3. Analytical study of the system components
4. Organizational aspects
5. Environmental aspects

6. Economics of the system
7. Developmental programme
8. Steps for implementation of recommendations and plans

1 Establishing Need For A System

One may encounter a specific problem and then begin to search for a solution to it. On the other hand, there may be only a vague general notion of existence of the problem as experienced by persons involved in the field concerned. For instance, in the information field, experience may indicate that a certain community of users is not getting adequate access to the information they need. One might then investigate, say through surveys, identify the specific information needs and the inadequacies of existing systems to meet the needs. This could lead to improvements in existing systems, and their utilisations, or the designing of new systems adequate to meet the needs, such an exercise of a detailed survey of needs, inadequacy of existing systems, etc, as a preliminary to making a proposal for a system of global dimensions could be too costly and time-consuming, if practicable at all. However, it is useful to examine the expression of experiences and the premises that have been formulated over the years, orienting the thinking and actions of peoples, institutions and organizations to develop a global information system for the socio-economic field.

11 Premises

1. Peace and prosperity in the world requires the creation of a new economic and social order - something different from the present order marked by dichotomies, distinctions, and discriminations, of haves and havenots, rich and poor, advantaged and disadvantaged, privileged and underprivileged, developed and under-developed.

2 The creation of this new economic and social order depends on co-operative and collaborative action among nations, institutions and social groups of all kinds, so as to bring about the appropriate economic and social changes, reducing the gaps between cultures, between nations and between social groups.

3 Knowledge is the principal instrument of socio-economic change, and the sharing of knowledge (intellectual resources) could be an effective means of reducing and bridging the gaps in and between societies.

4 The capability for knowledge transfer and information handling is both the potential for change as well as the indicator of achievement in material wealth.

5 Modern transport and communication systems have shrunk distance and time such that actions and happenings at one point have their impact, echo, and reverberations across space and through time. Therefore, one needs a broad perspective transcending the local context, to the national and international context.

Based on these premises, there is a growing recognition of the need to create the systems, the institutions, and the instruments which would help the movement towards this new economic and social order given the environmental context just mentioned. Information systems constitute one such instrument.

The preliminary recommendations of the Study Team contains three brief notes based on the postulates that DEVSIS is justified on the grounds of

- international equity, that the system will permit the sharing of information n socio-economic fields in a way that will permit a more equitable distribution of rganized human knowledge;

- immediate international needs, that there is a general recognition of the nperative for a new international economic and social order to cope with long-term nd recurring development crises that have global impact.

2 *Reports Of the Sixties*

The recognition of the need for global intersectoral, interdisciplinary developent information systems and programmes is not new. We are familiar with the ester Pearson report (8), which placed general emphasis on information and technoogy transfer to the developing countries. The Graham Jones report (6) which is omething of a continuation of the Pearson report, says:

> "Successful industrialization requires the provision of a whole range of supporting services to augment the technical and managerial competencies of individual enterprises. The services include technical information and library services; surveys of industrialization possibilities; technological, social, and economic feasibility studies; investment project studies; preproject planning; applied scientific research and pilot plan development, market research; layout, organization and productivity improvements; standards and specifications; testing laboratories and quality control; equipment services; technical trouble shooting; technical management consulting; and extension services."

Several pages of the report are devoted to technology transfer to developing ountries.

The series of conferences on the application of science and technology for evelopment in Asia (1), Africa, and Latin America, also emphasised the sharing of nowledge between nations. Sir Robert Jackson's study of the capacity of the United ations (5) identified the need for the establishment of an information system for UN's wn development activities as a priority need. The report points out: "The present N structure for development cooperation contains three levels of activity: (i) the evelopment level.... (ii) the executive level.... (iii) the field level..... All three evels play significant roles in economic and social development.... each substantive nit of the UN and some the Specialized Agencies plans and conducts its own proraimmes without significant references to the programmes of others". Following the eport, the UN set up the Inter-Organisation Board for Information Systems. The etting up of a computer-based Current Register of Development Activities (CORE), is 1 progress.

The international symposium held in Berlin in November 1969, which was ponsored by the German Foundation for Developing Countries, made a strong ecommendation for the establishment of development information clearing houses.

The comments and recommendations of the influential Conference Board, ontained in its publication "Information technology: Some initial implications for ecision makers" (1972), have now become common knowledge.

More recently, the Club of Rome, in its second report pointed out:

"All contemporary experience points to the reality of an emerging world system in the widest sense which demands that all actions on major issues anywhere in the world be taken in a global context and with full consideration of multidisciplinary aspects. Moreover, due to the extended dynamics of the world system and the magnitude of current and future change, such actions have to be anticipatory so that adequate remedies can become operational before the crises evolve to their full scope and force. If actions are to be anticipatory and effective, they must be based on a supply of information which is as complete and accurate as it can be made to be".

13 *Current Realities*

If there had been, over the past decade, the recognition by influential bodies, particularly international and intergovernmental organizations, of the need for development information system of international dimensions, why then action to establish such a global system was not initiated until 1974? Of course, there have been in operation a few international abstracting and indexing services in the economic and social science fields; more recently computer readable data bases have also become available in these areas. Most of these are discipline oriented, not mission-oriented; they are inadequate in coverage and scope with respect to development information; and most of them are not based on the concept of global participation of countries.

The DEVSIS feasibility report describes several surveys which indicate that little is known about development literature produced in developing countries, or about the 'grey literature' (government documents, reports, memoranda etc) produced anywhere. A fairly high proportion of the development literature produced in developed countries is abstracted and indexed many times over, both by secondary services and by individual organisations. This is an unsatisfactory situation leading to wastage of resources on the one hand, and the persons concerned with development planning and policy making having no reliable access to the information which is of interest and value to them most, on the other.

Until recently, there has been little experience and very few models of global information systems in which there was voluntary international cooperative participation in the design, operation and utilization of an information network. The International Nuclear Information Systems (INIS, 1966-1970) is the first example of decentralized input--centralised processing--decentralized product utilization. Then came AGRIS (1971-75). And now DEVSIS. In the meanwhile, through the programmes and projects of UNISIST (Unesco-ICSU programme for a World Science Information System) experience has also been gained in systems interconnection, compatibility, and convertibility.

The successful operation of these cooperative international information systems has demonstrated that the application of the "territorial" formula ensures the sharing of responsibilities and costs among nations on an equitable basis. This helps to eliminate duplication and to increase comprehensiveness of coverage of relevant literature. Countries have a national interest in bringing their own literature under bibliographical control; and once this is done, to submit information about that literature to a Central Unit for processing and distribution adds only an incremental cost which governments are increasingly willing to pay in order to regularly obtain information from other organizations and other countries. Thus, the experience of INIS and AGRIS is indicative of the feasibility of developing a mechanism for meeting the identified user needs which has not been achieved with the existing systems.

14 Genesis Of The Devsis Proposal

141 International Priorities

One might also ask why the sequence INIS, AGRIS, DEVSIS in the chronology of development of global information systems. International initiatives depend on international priorities. INIS came first perhaps because the superpowers were looking for ways in which they could cooperate in the nuclear field and build up the trust and confidence that could lead to an eventual detente. AGRIS came next because of the importance of food to all mankind. Ultimately such decisions are taken by governments. Perhaps, governments will be moved to action by the concern over the protection of the environment or by the energy crisis. However, there is a strong plea that the next global information system should respond directly to the needs of the large international community of persons who are concerned with economic and social development, in planning and operating programmes, in evaluation and in research.

142 Proposal For A Development Information System

A plea and a proposal for a development information system are contained in a paper entitled "DEVSIS": A development science information system" by John E Woolston (Director, Information Sciences, IDRC, Ottawa), distributed in January 1974. He proposed that "an effort should be made to build a cooperative information system with decentralized input/output making use of the organizational and technical experience of INIS and AGRIS and founded on the principles of UNISIST". He also proposed a schedule of action and indicated the role of the International Development Research Centre (Canada) in the programme (9).

The proposal received encouraging response from different groups, and an international conference was convened in Ottawa in June 1974 to discuss the project. General recommendations about various aspects of the system and the formation of a Steering Committee and a Feasibility Study team were made.

The Steering Committee at its first meeting on 16-18 October 1974 in Paris, adopted the following Statement of General Purpose and Objectives of DEVSIS:

"In the overall interest of providing equal access to information, the general purpose and objectives of DEVSIS should be:

1 (a) To improve access to economic and social development information to individuals and institutions, particularly in developing countries, and especially to those involved in the formulation and implementation of development activities in governments and intergovernmental organisations.

(b) To foster the building and utilization of national and international resources needed to meet this goal.

(c) To improve coordination between the existing development information, including library facilities.

2 Within the overall concept of evolving a future oriented programme for economic and social development information of broad scope, an international development information system (DEVSIS) should be prepared, which would:

(a) Provide information services to users working in the development field at the national and international governmental and non-governmental levels (including the academic community) in developing and developed countries;

(b) Be responsive to the expressed needs of its users, and, following reviews and evaluation, to adjust to effective needs within a constantly evolving world context;

(c) Be responsive to appropriate technological advances in communications and to interconnection with other related systems, and thus contribute t meeting the priority information needs for the establishment of a new international economic and social order (General Assembly Resolution 3201 S (VI).

3 DEVSIS should cover both published literature and unpublished documents and data. The system should be based on the concept of decentralized input, centralized merging, and decentralized output services; it should thereby help contribute to the development of adequate information infrastructure and resources at the national level.

4 DEVSIS should be managed within the United Nations System.

5 DEVSIS should be open to the participation of interested Member States, as well as of intergovernmental and non-governmental bodies concerned with problems of development.

6 DEVSIS should be developed within the conceptual framework of the UNISIST programme; its design should take into account the experience of other operational and experimental information, including library systems.

7 All countries should be encouraged to give consideration to development information as an important component in the formulation of both their national development policies and their national information policies.

Under the guidance of the Steering Committee a Study Team was set up which is responsible for developing the system design for DEVSIS. The team would also identify existing relevant activities and resources in both developing and developed countries; define technical aspects of the system, such as, scope, coverage, required outputs, input and processing procedures, etc; and examine the financial and legal requirements of DEVSIS and recommend alternative options for implementation.

In the first phase of its work the Study Team was made up mainly of individuals who have had direct or indirect experience with policy making, planning, and research; the members came from different countries and cultures. The preliminary recommendations regarding the categories of users, the scope, and organization of DEVSIS are briefly mentioned below.

2 Scope Of The System

21 Responding to the Needs of Policy-Makers· Planners and Researchers

211 Potential Users

The Study Team has tried to take into account the needs of

(a) Policy makers with respect to socio-economic development at governmental and non-governmental levels, nationally and internationally;

(b) Planners - strategic, tactical, operational - of socio-economic development projects and programmes, including formulation of social and economic indicators, forecasting; and pre-investment studies at various levels; techno-economic and social surveys, including the scanning of the socio-economic and socio-political environment; and assessment and performance evaluation of projects and programmes;

(c) Researchers and teachers of socio-economic development subjects and those involved in management of research projects and programmes;

(d) Financiers who provide resources and technical co-operation for development projects and programmes. Likewise those who provide consultancy and advisory services; and

(e) Personnel concerned with information analysis and products thereof and those who provide support service to the categories of users mentioned above.

212 Information Needs

The Study Team consensus is that these groups feel the following needs:

(1) To better understand the present status and trends in the economies and societies for which they are taking decision and making plans, and the implication of these trends for the future;

(2) To have access to information on programmes and projects closely related - in content and intent - to those on which they are working, in order to have the possibility of benefitting from the experience of others, in their country or elsewhere, and to effect coordination of efforts;

(3) To receive digested background information on major trends in development philosophy and experience, probably in the form of short, readable monographs (supported, where appropriate by synoptic tables, graphs and charts); and

(4) To know where to go to get specialized information, data and statistics when particular needs arise.

22 *Inferences*

Following a detailed discussion of these priority needs, the DEVSIS Study Team has drawn a number of conclusions.

221 *Organisation to capture unpublished information*

The first conclusion that may be drawn for the statement of priorities is that DEVSIS must place a special emphasis on the capture of unpublished information. Further projections (item 1) and programme and project reports (item 2) often now exist only in the internal files of ministries, banks and other institutions. This has implication for the organisation of DEVSIS which must be able to demonstrate that an institution that participates by making its own unpublished information available will enjoy compensating benefits by having access to the contributions of other institutions.

222 *Access to full texts*

The second conclusion is that DEVSIS must contain a well organised sub-system for providing rapid access to the full tests of the documents that it records. Since unpublished documents are not available in libraries around the world, all such documents reported to DEVSIS must be copied on microfilms or microfiches and sets of these placed at all major output stations in the DEVSIS network.

223 *Indexing abstracting and data extraction*

The third conclusion that can be drawn is that entries in the DEVSIS file, especially those relating to pre-investment (including feasibility) studies and project reports, should be indexed in depth and, as far as possible, should be abstracted in such a way that key data are immediately available from the computer record.

224 *Methods of economic analysis and models*

The fourth conclusion is that there is a high-priority interest in the methods and models used for calculating the effects of development actions (and of any changes in the parameters used), and for predicting trends in various sectors and sub-sectors of global, regional and national economies. DEVSIS should be particularly hospitable to information about such methods and models and about the computer programmes that are available for carrying out the calculations. Such records should necessarily include a notation of the source and availability (and, where appropriate, the cost) of obtaining the documents or programmes.

225 *Information analysis services*

Future predictions (whether quantitative, as in tables or graphs, showing supply/demand relationships, or qualitative as in assessments of the changing content of educational programmes) and digests (which again may be either quantitative or qualitative) imply the investment of intellectual resources on a large scale. The professional staff (and, hence, the cost) is far greater than that needed for a basic DEVSIS service. The fifth conclusion is, however, that DEVSIS should aim – as soon as possible – to build a service for digesting material of various forms such as

- information digests
- statistics
- forecasts.

Meanwhile, DEVSIS can, from its first days, provide referral to the organisations that offer services in these areas.

226 *Links to other systems*

And the sixth conclusion is that DEVSIS itself cannot meet all the priority needs, but, where it does not, it should provide a means of access to other sources of information, public and private, benefitting from UNISIST's work on systems interconnection.

227 *National participation*

The seventh conclusion is that the DEVSIS programme must involve a strong component to foster the building of the necessary national information policies and national information infrastructures to support the users, to exploit the services that DEVSIS will provide, to identify the gaps in available information, and to motivate authorities to fill these gaps (7).

23 *Categories of information material*

The following categories of information material are proposed by the Study Team as candidates for admission to the DEVSIS data base:

1 Basic Economic and Social Information and Data

1.1 Basic information and data: international and national levels.

Statistical and other factual information and data relating to economic and social conditions and phenomena (such as, resources, production, consumption, distribution, trade, and other transactions) as applied to the entire world, to regions of the world, or to particular whole countries.

1.2 Basic information and data: sub-national levels.

Same as for 1.1 but as applied to particular localities and to sub-areas within a country.

1.3 Information on existing social and economic situations: international and national levels.

Descriptive accounts and studies on the economic, social, political, and legislative structures and of the causes for underdevelopment and of factors favouring development, as applied to the entire world, to regions of the world, and to particular whole countries.

1.4 Information on existing social and economic situations: sub-national levels.

Same as for 1.3, but as applied to particular localities and sub-areas within a country.

1.5 Forecasts on trends: international and national levels.

Papers on trends in economic, techno-economic and social conditions extrapolated into the future, as applied to the entire world, to regions of the world, and in particular whole countries.

1.6 Forecasts on trends: sub-national levels.

Same as for 1.5, but as applied to particular localities and sub-regions within a country.

2 *Theories Models and Methodologies*

2.1 Models, Methodologies, Tools, and Techniques of study.

Papers on socio-economic models, econometric models, development indicators, methodologies, tools, and techniques (including computer programs) helpful in forecasting, planning, and other development studies, and evaluations of these.

2.2 Theoretical studies: international and national levels.

Theoretical and similar studies and evaluation of such studies on economic and social development and development policy formulations as applied to the entire world, to regions of the world, and to particular whole countries.

2.3 Theoretical studies: sub-national levels.

Same as for 2.1 but as applied to particular localities and sub-regions within a country.

3 *Development Policy, Plans and Strategies*

3.1 Statements of development policy

Documents issued by international, regional, national and local authorities and organizations, banks, funding and investment agencies, and political parties, defining or explaining their policies in relation to the pursuit of development goals.

3.2 Plans

Official plan documents, descriptive accounts of plans and statements issued by international, regional, national, and local authorities and organizations, banks, funding and investment agencies and political parties, detailing their development plans, programmes, resources allocations budgets, time target, etc.

3.3 Reviews and evaluations of development programmes

Official and non-official commentaries, reviews and evaluations of the policies, plans, and programmes (For individual projects sec 3.5).

4 *Studies on and for Development Tactics*

4.1 Pre-investment studies and their evaluation

Pre-investment studies (including feasibility studies and market survey) and their evaluations. for specific development projects.

4.2 Tools for pre-investment studies

Papers on econometric models and techniques (including computer programs) useful for the elaboration and evaluation of pre-investment studies (including feasibility studies).

4.3 Development resources (general)

Studies on the availability of resources for development at global, regional, national, and local levels.

4.4 Development resources (specific)

Studies identifying particular development resources, and guides and directories for such resources information.

4.5 Operational experience (general)

General reviews and evaluatory papers on experiences in implementing development projects and programmes, including managerial, financial, legislative and administrative aspects. Aspects of coordination of development activities; institutional arrangements and cooperation.

4.6 Operational experience (particular projects)

Descriptions and progress reports of particular development projects and programmes; reviews and evaluatory reports of experiences in particular projects, including managerial, financial, legislative, administrative, coordination and control experiences.

5 *Studies on Consequences of Development Efforts and Activities*

5.1 Economic impact: international and national levels

Analytical studies and interpretations of the economic impact of development policies, programmes, and projects, at the international, regional, and national levels.

5.2 Economic impact: sub-national levels

Analytical studies and interpretations of the economic impact of development policies, programmes, and projects, at local level and at the level of subareas within a country.

5.3 Social impact: international and national levels

Analytical studies and interpretations of the social impact (including political and cultural) of development policies, programmes, and projects, at the international, regional, and national levels.

5.4 Social impact: sub-national levels

Analytical studies and interpretations of the social impact (including political and cultural) of development policies, programmes, and projects at the local level and at the level of sub-areas within a country.

5.5 Evaluations

Evaluatory reports of the results and achievements of specific development strategies, programmes, and projects.

Exclusions: Information qualifying for admission to DEVSIS under any of the categories mentioned above would, nevertheless, be excluded if it

either (a) is trival or redundant;
or (b) contains exclusively technical information, even when such technical information has been collected for, or is a result of, particular development programmes or projects.

The admission of sectoral information (as opposed to non-sectoral or cross-sectoral information) may be limited to that defined as directly pertinent to the DEVSIS mission. The Study Team has drawn up a table of proposed limitations in regard to sectoral information for each category listed above.

The categories of information to be admitted and excluded from DEVSIS are now being checked with actual documents with a view to understand the problems of identification, and improve the definitions, categorization, etc.

24 Devsis Files

Information pertaining to development is found in many sectors and the existing information services covering some of the sectors may overlap with DEVSIS. Where this is identified, the recommendation is for close cooperation with those systems — if they are internationally based and providing comprehensive coverage — in order to draw clearer boundary lines between those systems and DEVSIS.

Need has also been felt to make a distinction between information generated in response to development mission, and the more aggregated information from other sectors which is also used by the decision maker. The Study Team has recommended that DEVSIS contain, to begin with, two data bases (File 1 and File 2). These files would form the basis for the major printed products of the system, namely, Devindex and Devprofile. The two files are made up respectively as follows:

(1) File 1 — A comprehensive file with bibliographic references, abstracts and extracted key data, which would include references to such materials as computer programs, feasibility studies, project evaluation reports, market studies, etc. The file should be an integrated file, but it should involve multiparameter indexing to permit effective retrieval of specific information; for example, by type of information, by form of presentation, by subject, by sector, by geographical region,etc. The scope criteria is intended to ensure that, as far as possible, this integrated file would reflect the priority needs that have been outlined. The scope criteria would apply to all types of information entered into this file. - (FILE 1)

(2) File 2 — A data file on specialized sources and services available in the world dealing with topics relevant to socio-economic development. This file would be constructed to facilitate referral of enquiries to appropriate other sources and services.

25 *Language*

Estimate of the quantity of literature produced and used in the developing world — Asia, Africa, Latin America — indicates that the major languages which DEVSIS will have to handle are: English, Spanish, French, and Arabic. To begin with, DEVSIS would be hospitable to English, Spanish and French. In due course, capability for computer processing of Arabic characters would be developed.

26 *Products/Services*

The principal outputs are expected to be available on magnetic tape as well as in printed form: Devindex, the main bibliography of current development literature, with indexes; and the file on magnetic tape. It is recognised that users in developing countries often face difficulties in having access to documents. The Central Unit will, therefore, maintain a microfiche back-up file for all documents and reports not restricted by copyright law, and copies of documents can be obtained from this file. Participating centres can use DEVSIS output (on magnetic tape, printed form, and on microfiche) to produce specialized products and services for their own user communities. For example, bibliographies on specific subjects, SDI service, area bibliography, etc.

3 *Analytical Study of System Components*

The technical aspects of the data base, of the information processing, and of the output have been considered in some depth and detail by the Study Team. Experience gained with other global systems and the specialised characteristics of DEVSIS have been taken into account. Giving details of the recommendations here would amount to reproducing a good part of the feasibility study report! I shall only mention the titles of the chapters in the report which deal with the technical aspects.

Section B : Technical Aspects: The Bibliographic File (File One)

Chapter 11 : The DEVSIS record

12 : Parameters for indexing and retrieval

13 : The Creation of the File

14 : Outputs from the DEVSIS Central Unit

15 : Full-text service from the DEVSIS Central Unit

16 : Outputs from participating centres

17 : The DEVSIS Network

Section C : Technical Aspects : The Referral File (File Two)

Chapter 18 : A centralized operation

19 : Content and format of the referral file

4 *Organizational Aspects*

The institutional framework of DEVSIS should be established to ensure the participation of:

- the producers of the information that will be sought for the DEVSIS data base
- the major users of the information that will be provided from the DEVSIS data base.

The institutions likely to be involved include international and regional organisations concerned with development, national governments, banks and other organisations financing development investments, public and private foundations, and research institutions.

We need also to envisage the possibility that DEVSIS may be financed by a consortium of organisations, and that the organisations providing resources — financial or otherwise — will seek a voice in the governing of the system.

The question then is — how can all these institutions best be brought together in one network?

There is clearly a need for the kind of mechanisms that only the United Nations system can provide, particularly:

- mechanisms for communicating with government and enlisting the participation of governments;
- mechanisms for providing long-term financing according to a formula of fai distribution of costs to governments;
- mechanisms for enlisting the necessary political and public interest, for example, by resolutions of the Economic and Social Council and the General Assembly of the UN;
- mechanisms for associating DEVSIS with other major international information programmes.

One of the working groups at the Third Session of the DEVSIS Steering Committee in July last, considered global organisation and financing of the System. While accepting that it would be premature to specify a long-term solution for the management of DEVSIS, the Working Group noted the desirability of eventually incorporating DEVSIS within the regular programme and budget of an appropriate agency; given the present structures, the most interesting candidates would be:

(a) an agency with broad responsibilities for economic and social development. At present this could be the UN Department of Economic and Social Affairs (ESA), or the UNDP. If the report of the Group of 25 is implemented, it could be the proposed UN Development Authority (UNDA).

(b) an agency with broad responsibilities for information programmes. At present this would be Unesco with particular reference to its UNISIST activities which are now being expanded into the economic and social sciences.

(c) an agency with the appropriate personnel and equipment resources acting on behalf of the UN system as a whole. At present this could be, for example, the ILO making use of the facilities of ICC.

(d) an inter-agency body with general responsibilities for information systems; at present this would be the IOB, but it is put at the end of this list because such a solution would be placing the activity at one step more removed from direct control by Member States.

The Working Group noted that there was interest in the secretariates of ESA, Unesco and ILO for possible future responsibilities for DEVSIS.

For the policy-making body, the Study Team recommends the creation of a Governing Board with broad representation, including sponsoring agencies as well as representation, on the basis of geographic regions, of participants providing input to the system as well as users.

The DEVSIS concept necessarily involves the production of a central file. It may be produced by merging any number of regional or national inputs, but there must be a central operations unit to handle the physical production of the comprehensive file. Technical skills and a computer capability must be available at the central operations unit. An arrangement like that of AGRIS may be possible — with the secretariat and management functions carried on in one organisation and the computer processing in another.

In reviewing the management functions of the Central Secretariat, particular emphasis is placed on providing support to the technical and financial advisory bodies, on network support and on cooperation with other international information systems.

5 *Environmental Aspects: Supporting Programmes*

In order to ensure smooth technical functioning of the system various standards, manuals, guidelines, authority lists, indexing, vocabulary control tools, etc are essential. The existing tools, particularly the ISO, and UNISIST formulations and used in other international information systems have been taken into account. Wherever found necessary, programmes and projects for development of new tools or for improving existing ones have been suggested and/or initiated.

The role of participating national centres and guidelines for selecting such centres have been outlined. The programmatic role of regional centres with respect to areas where national information infrastructures are yet to develop has been identified. Recognizing the need to keep abreast of developments in information processing and computing technology especially in regard to input devices and small scale computers, the DEVSIS would make available to the national centres a body of knowledge and advice developed centrally and regionally when making decisions about choice of computer hardware and software.

6 *Economics of the System*

Based on past experiences of operating global information systems of a pattern similar to the one proposed for DEVSIS, estimates of staff required to perform the various tasks and some of the cost elements are given in the sections dealing with technical aspects of the system. When DEVSIS goes into operation, may be three years

from now, more experience would have gained with the interim organizational model (See Sec 7), the number of likely participating centres would be known more accurately, and information on the extent of usefulness, efficiency and economy of input and processing devices, such as the OCR equipment now being experimented with, would be available. There may also be other information technology developments which may prove useful to incorporate in DEVSIS. Some of these features would necessitate revision of the cost of operating the system. Here, we are considering mainly the cost of operating the Central Unit, the Central Secretariat and the services they provide. It will be remembered that the cost of making inputs to the system would be shared by the participating centres in different countries. The report indicates only the facilities required for national and regional centres, because the cost and the staff will vary with the volume of material to be processed, the facility and equipment already available and the size and interests of the user community.

7 *Development Programme and Implementation Schedule*

The ultimate objective is to get DEVSIS incorporated into the programme and budget of a UN organization. (The location of the Central Unit in a developing country is not also ruled out). But considering the nature of the cycle of movement of proposals, such as that of DEVSIS in UN bodies, and the budgeting process, it may be three to six years before DEVSIS becomes fully operational as an integral programme of the UN system. For the interim period, an organisational model which would locate DEVSIS Central Unit within a UN organization and also provide useful experience and opportunity to study a little more realistically the implementation of the various suggestions and recommendations, and user reactions, three options have been considered: The UN Department of Economic and Social Affairs (using the computer facilities and technical resources of IAEA), Unesco (using its own computer facility or that of ICC in Geneva), or the International Labour Organization (using the computer facilitv of ICC).

The cost of the three-year programme may come to $ 1.6 to $ 2.0 millions depending upon which components of the system are put into operation first, and the rate of development of the system. The rate of development would be influenced by the number of national participating centres involved during the three-year period. The financial estimate includes support for planning national participation.

Several alternative sources for the extra-budgetary finance of the interim operation have been considered: e.g. UNDP support for a global project, funding through a trust or a consortium established by several interested organizations, or a combination of these.

The jobs to be done during the period to enable the start of regular production cycles are defined and the staff required to these jobs is also identified. The phasing of these jobs in various combinations to provide a number of operational options, at different costs, during the interim period, is delineated.

8 *Conclusion*

The objectives of DEVSIS are broad and laudable in that the achievement of the objectives would help the establishment of the new economic and social order. Right from the beginning the system has placed emphasis on service to developing countries, and on effective national and regional participation, particularly of the developing world, in the development and operation of the system. DEVSIS would also collaborate with

other international bodies such as UNESCO and regional institutions in building up strong national information infrastructure which, in turn, would contribute to an efficient and effective operation and utilization of DEVSIS in the long run. The standards and guidelines for information handling and systems interconnection developed under UNISIST auspices would be utilized in DEVSIS.

The characteristics of DEVSIS operational model would be similar to that of INIS and AGRIS. However, there are a few differences. Some of these are presented in the appendix.

Comparison of some Features of INIS, AGRIS, and DEVSIS

Feature	INIS (1971–)	AGRIS (1975–)	DEVSIS (proposed)
of subjects covered	Nuclear science, and technology — hard sciences; interdisciplinary, but fairly well defined	Agriculture and allied fields—interdisciplinary, but less well defined than nuclear science and technology	Economic and social development—a large part soft science; cross-sectoral, and more interdisciplinary and less well defined than agriculture
2 Orientation	Serves predominantly research workers, engineers and technologists	Serves predominantly research workers, teachers, and to some extent, agricultural development planners, governments	To serve predominantly policymakers, planners, financiers, researchers, and information analysts concerned with socio-economic development at all levels, particularly in developing countries.
3 Types of documents covered	Books, articles, reports, theses, etc, mostly produced by research workers, engineers and technologists	Similar to that of INIS	In addition to books, articles, theses, etc greater emphasis placed on capturing the unpublished literature, such as project reports, pre-investment reports, administrative reports, etc.
4 Major part of the input from	A few developed countries	About 60 per cent from developed countries; about 40 per cent from developing countries at present	Mainly from developing countries; specified type of information from developed countries.
5 Language	Predominantly English as the carrier language. French and Russian versions of INIS thesaurus produced	Predominantly English as the carrier language. Problems of using other languages may arise in due course	English, French, and Spanish proposed as carrier language to begin with; Arabic may be next in line.
6 Terminology of the field	Fairly well defined technical terminology	Less rigorous than for nuclear science	Much less exact than in nuclear sciencet and agriculture. Often difficult to find one-to-one equivalents for terms in different languages. Words often carry connotation which reflect the predominant social philosophy of the society in which they are used.
7 Universality of concepts/ideas	Concepts are fairly universal.	Less universality of concepts than in nuclear science	Much less universality; the economic, cultural, and demographic environment—affects the universality of ideas.
8 Output products and services	Mainly list of references (Atomindex); microfiche doc back-up	Level 1 : List of references (Agrindex) Level 2 : Specialised subject services: abstracts, digests, etc. (proposed)	List of references with abstract and referra service. initially (Devindex) Listings for a region may be provided. Digests, compilation, information analysis, and synthesis, forecasts, etc, in due course Microfiche document back up.
9 Data base (computer files)	Mainly citations; inclusion of abstracts under consideration	Mainly citations	To include abstracts for the documents in the computer file A computer-readable inventory or information sources in the field, including computer software packages availability information.
10 Input communicating medium	Magnetic tape, paper tape, worksheet	Magnetic tape, paper tape, worksheet	(To be decided)
11 Number of items processed per year	About 70,000	About 250,000 ultimately	100,000–200,000 (?)
12 Number of input centres	About 40 at present	Mainly CAIN, CAB, a few regional centres and national centres at present	May be over 100.

13	Dispersal of information generating centres	In each country concentrated in a few centres	In each country dispersed in several institutions and projects	In each country, dispersed in a large number of institutions and projects.
14	Organization	Decentralized input-centralised processing-and decentralised input use	Similar to that of INIS	Similar to that of INIS. Strong emphasis of participation of regional centres.
15	Cooporating/cosponsoring bodies	IAEA, governments	FAO, governments, regional centres	A UN body, governments, intergovernmental organization, financing institutions (?).
16	Feasibility study to service time lag	1968–71, about 3·5 years	1971-75, about 4·5 years	1975 — ?

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PAPER B. 3

APPROACH TO SCIENCE AND TECHNOLOGY PLANNING — NEED FOR A NATIONAL INFORMATION GRID SYSTEM*

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In the post Second World War era most of the Governments, especially of the advanced countries, have been organised to absorb scientific and technological developments with a view to achieve national goals and aspirations. Scientific and technological progress has been recognised as one of the important facets of modern Government and the development of the economy has also been geared to national programmes for progressive development built on a scientific and technological base. The various limbs of the United Nations organization are also increasingly organising themselves to the application of science and technology in the various forms of assistance to the developing countries. Many of the developing countries are also committed, like India to a national science policy, which would ensure the appropriate role of science in the development of the country. Further the concept of planning for national development is no longer a matter of opinion or for debate. Against this background and approach, which is conceptually evolved on scientific and technological planning and projection of development programmes, the developing societies like ours are increasingly committed to organising the technologically oriented information system in an appropriate manner.

2. Information processing in terms of collection and compilation system, translation and transmission of information published, literally in millions of technical and scientific papers, books, journals, conference proceedings in hundreds of different disciplines and in many languages is perhaps one of the important facets in the development and transfer of science and technology. There has been a steady growth in the output of scientific and technological literature the world over for e. g. estimated 10, 000 in the beginning of 20th Century to 100, 000 in 1950 and expected to tip 1, 000, 000 by 2000 AD! Publication of scientific and technological journals in our country has also steadily increased as shown in the following table I:-

Importance of Technological Information System to Decision Making

3. The importance of information, especially of the technological type to the policy makers, the executives, the administrators as also the coordinators, concerned with all aspects of our developing economy, needs no fresh emphasis. Any objective oriented management system depends on the availability of the correct information, accurate information and timely information to all those concerned. For effective decision making, a properly organised information system is an inescapable necessity and all progressive organisational structures are built around an efficiently organized information management policy.

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*The views expressed by the authors are personal and do not reflect official views

Table I

Number of scientific and technical journals published

Subject field	1955	1960	1964*	1968**
1. General, pure and applied physical science.	68	91	101	143
2. Biological sciences	30	42	48	36
3. Medical sciences	58	85	92	202
4. Agriculture and Horticulture	28	39	47	128
5. Animal Husbandry and veterinary sciences	7	10	14	29
6. Engineering	37	59	67	191
7. Chemical technology	21	29	29	82
8. Manufacture and management	11	17	19	157
9. Building industry and architecture	6	9	9	12
10. Popular Science	76	124	149	170 (estimated)
Total:	342	505	575	1150

(* Science Journals in India, Research Survey and Planning Organization, CSIR, New Delhi)

** Directory of Indian Scientific Periodicals; (second edition) INSDOC, New Delhi.

4. The industrial policy, the import/export policy, the small scale/large scale industries programmes, the Five Year Plans, the science policy, the education policy etc. have crucial implications for the development programmes and for the progress of the economy of the country. The tenets of such policies are not rigid or static for all times to come: they may have to be revised or redrawn or appropriately oriented in accordance with the pace, quantum and quality of development in course of time. In the implementation of many of these policies, several committees, agencies

and organizations of the Government take decisions from time to time, which are again dependent on the availability of the background information which is reliable, recent and sufficiently accurate.

5. The problem of information management has become quite voluminous, complex and detailed for the Government and for the public sector organizations. With the orientation given to trading in the public sector, for organisations like the STC, MMTC, IOC, FCI, Food Corporation etc., the importance of keeping reliable information and projecting it on a timely basis has become inescapable. For this purpose the maintenance of information of the entire country's requirements of raw materials, the stock available, past data, allocations needed, adjustments necessary, important problems pertaining to international prices, shipping demands and so on, call for an aggressively oriented information management system.

6. Most of the economic Ministries of the Government, like the Ministry of Industrial Development, Finance Ministry, Ministry of Petroleum and Chemicals, Ministry of Mining and Metals, Steel, Department of Science and Technology etc. are all concerned with several aspects of industrial and agricultural production programmes. Industrial targets, demand and production analysis, trade requirements, transport, capital goods requirements and raw materials needs and several other facets of economic development are becoming a part and parcel of the regular day to day functioning of the governmental set up.

Information for Application of Science & Technology

7. The emphasis on abstracting service confined to research journals and books on science and technology to meet essentially the requirements of the bench workers in the laboratories of the research and development organizations has to be suitably modulated. Apart from the bench work, the needs of application of science and technology to development programmes as also the role of science and technology in the decision making processes of various levels of the governmental machinery, are becoming critical. For example, some aspects of the type of data required for example, some aspects of the type of data required for horizontal transfer of technology oriented to needs of the country are indicated in table 2.

8. The Scientific & Technological manpower policies and implementation have significant importance for several aspects of government today. Information systems have to be geared to various issues of manpower development, deployment and diffusion. Information on the stock available, that deployed, the excess or shortfall in different areas, the continuing turn over from the training institutions and its impact on the current or existing pool of scientific/technological manpower are to be oriented and integrated. Progressive measures are required to keep a close tab on the syllabus and training content, on the availability of teachers or training staff and their deployment over the whole range of the institutions spread throughout the length and breadth of the country. Here again there are problems of surplus, shortfalls and demands as between various States or within the State, between various districts and smaller administrative units. The problem of unemployment of scientists, technologists, engineers and technicians has assumed considerable magnitude calling for appropriate orientation of the recruitment, rehabilitation and retraining programmes. Job analysis, mobility, transfers are important facets, of personnel policies; schemes for terminal benefits, re-employment, absorption of personnel from say the Defence Services or rural areas call for an aggressive policy and implementation.

Table 2

	Type of data required					
1. Science and Technology (Transfer)						
1.1 Licensing of industrial units.	Raw Materials	Know-how and technical processes.	Plant equipment.	Capacity and production established.	Plan targets	Demand
1.2 Import of know-how	Collaboration agreement	Foreign exchange implications.	Choice of technology.	Restrictive clauses	Possibilities of sharing know-how	Exports if any
1.3 Import and export of equipment and raw materials	Licences implementation.	Stocks	Components and spares	Trade agreements	Future markets	
2. Sciences & Technology (Generation)						
2.1 Research	Fundamental	Applied Research	Equipment & Instrument	Personnel	Survey and Exploration	Quality control, testing & analysis.
2.2 Development	Pilot plants	Semi-commercial production.	Collaboration with user agencies.	Design Engineering & Consultancy.	Trial, Marketing, distribution.	

9. Design, consultancy and building up of process know-how is an essential part of the S & T programmes. The availability of expertise, the know-how developed indigenously, the know-how by types and details of that imported from abroad etc. have a crucial role to play both in the public and private sectors of our economy: the organizations in these sectors depend on the availability of information from the government agencies as also from the trade, industry and commercial agencies. The technical information from Government or non-governmental files or reports have to be collected and collated technologywise, regionwise and expertisewise, in any particular area or field.

Sources of Information

10. The National Sample Survey and the CSO bring out statistical information which is used by the Government for all its policies and projections. Institutions like the Rubber Board, Tea Board, Coffee Board and Cashewnut Board etc. also bring out reports periodically on cultivation programmes, quantum of production, imports/ exports in that field etc. Progress reports are brought out by a large number of laboratories, organizations concerned with production, trade, manufacturing etc. in the private and public sectors which give scientific, technological and statistical information on fields of interest to those specific agencies. The Annual reports to the Parliament by the various Ministries and Departments of the Government give an idea of the investment and expenditure both plan and non-plan every year. Apart from these, Study Groups or Committees set up by the Central Government or State Governments, Planning Commission, the NCST and others, publish reports and reviews on important topics.

11. At every session of the Lok Sabha, Rajya Sabha or the Vidhan Sabhas, questions are asked and information elicited from the Government. Committees like the PAC Estimates Committee etc. of the Parliament again bring out fairly comprehensive and important findings which have a bearing on the functioning of the governmental agencies, industries, trade, commerce etc. Every year large number of seminars or symposia are held in the various regions of the country which again project important recommendations and give reliable information and findings. We have also several international symposia and seminars publishing facts and figures and recommendations pertaining to a large number of disciplines.

12. The above publications and reports are important sources of information, which could be processed technologywise, subjectwise and user agencywise. An organised information system could project the past and the present thinking on the extent of implementation of the policies of the Government which have a bearing on the programmes of development in the country.

Management of Information

13. Management of information essentially comprises of acquisition, storage, retrieval and dissemination. With the availability of modern mechanized tools, equipment and instruments, it is possible to organize each one of these four elements to meet the requirements of ease of availability, dexterity and quick processing.

(i) Acquisition & Storage - Information is available from large number of books, documents, papers, photographs, films, tapes, etc. which are continuously being produced. As against the classical methods of storing such books,

documents etc., on the shelves, today the feasibility exists of condensing such information through micro filming techniques or by appropriately designing filing systems, having punch cards, tapes etc.

(ii) Retrieval - Depending upon the degree of mechanization resorted to, the process of retrieval of stored information is also becoming more mechan and perhaps controlled by electronic systems; the older practice of depen on manually operated retrieval systems is becoming difficult to cope up w the volume and the accelerated pace of work.

(iii) Dissemination - The process of dissemination is also becoming comparat vely simpler with the availability of several types of mechanized reprogra processing techniques and methods (as for e.g. xerography).

14. The basic techniques of the four aspects of information management have been revolutionised in the last two decades. Computers have played a significant role in th regard. Information management, which has to play a very crucial role when geared to the goals of a developing economy, has to be more machine oriented and will have to play an aggressive role rather than a passive function.

Information Processing: Present Approach

15. Information systems were organized around libraries and the acquisition of boo and journals, card indexing and abstracts were considered as the goals of information management. The emphasis is on manually operated techniques and the element of speed in rendering an 'information service' is essentially lacking. Information 'acquisition' and 'storage' as the primary aim were associated with the 'intellectuals o the society' and for purposes other than management of industrial organizations or enterprises or for scientific and technological institutions or for governmental machine concerned with decision making. There has been, however, a gradual switch over by the scientific and technological agencies and their complement of establishments who a increasingly recognizing the role of successful information management on modern lines. Several organizations in the public or private sector have set up their own information systems, but specifically to meet their requirements. In the field of science and technology, the INSDOC and DESIDOC have been created which essentially cater to the scientific sector and that too for the requirements of the 'research scientists' essentially. Apart from the various universities and teaching institutions like colleges, etc. which maintain library systems, the national laboratories, Atomic Energy Commission, ICMR, ICAR etc. and some of the Government departments, are also evolving information services with a bearing on industrial development, agricultur development etc.

Information Gap

16. Since existing information systems only meet certain limited ends, and long range perspectives or inter-dependency aspects do not receive appropriate attention, it has led to 'information gaps'. Within a particular agency (with a large complement of units or establishments under it) or within a single unit or establishment (with its divisions and sections), information needs are related to the areas or fields or disciplines relevant to specific charter of work of that institution: the process of storage, retrieval or dissemination have been geared to the specific requirements of the organisation viz. the interests of the users within a particular set up. Even here, considerable amount of gaps do exist because of the large volume of available sources

as against the necessity to filter and avoid too large a coverage due to very limited availability of resources. Such gaps are sometimes called 'vertical gaps' in information.

17. A more discernible gap is in the lack of organized flow of information from one agency or organization or institution to another. Quite often the information projected by one of the institutions or agencies have an important bearing on the information needs of the other; a free flow and exchange would avoid large areas of overlap and in some cases would fill up the gaps on a vertical basis within the other organization also. In turn the agencies could spend their resources more effectively in limited spheres or areas in depth, and could be complementary to each other; this would enable availability of information on a mutual basis while a wider coverage in depth is feasible. The effective horizontal transfer of information is becoming vital to the processes of economic development at an accelerated pace. Therefore a planned approach to organize the information management to ensure that the vertical gaps of specific agencies are plugged while a free horizontal flow is permitted, would effectively contribute to a total pool of information on a centralized basis.

A Model for National Information Grid

18. A model which could be considered in this context for an efficient information flow and linking up of various bodies in different regions of the country as also the central agencies, would be based on a 'grid system' with a central nucleus linked with several regional units located in the various geographical regions of the country.

19. The following chart I indicates broadly the flow of information through the national grid system for planning, decision making and implementation of activities where predominently science and technology plays a critical role in various sectors of our economy. The itemized heads are suggestive and indicative and not necessarily comprehensive to cover all aspects, issues and facets of the problem.

20. The regional and national information centres could be organized on a bifunctional basis of 'subject divisions' and 'data analysis groups' broadly as indicated in the Chart 2.

Role of Regional and National Information Centres

21. The role of the 'Regional Information Centres' (RIC) and that of the 'National Information Centre' (NIC) will be primarily to link up and promote free flow of information. The emphasis in these Centres will be on 'processed information' i. e. utilizing the data and raw statistical material from various sources and converting the same to meet the users' and requirements. Evidently the information centres (Regional or National) will not build up infrastructure for collection of primary data or raw statistics: this will avoid duplication of the efforts by a large number of information cells or information units already located in the various laboratories, public and private sector institutions, universities and several information centres of the State and Central Governments.

22. The NIC will be responsible for implementation of the National Information Policy which should be drawn up by the Government. National Grid could be in touch with the user agencies at the centre (as well as State where necessary) and with their help evolve the type of information required to be collected on a continuous basis. The

National Centre could guide the regional information centre to collect the required information in a standardised manner, collate the information and produce status reports periodically.

23. These Centres can take necessary steps in an advisory, recommendatory and where necessary, an executive capacity to strengthen the information base already bui up in existing institutions or assist in setting up new technical information cells or uni within the appropriate organizations or establishments in the private or public sectors at the State or Central Government levels and ensure appropriate coverage of all area of S&T as also regions of the country.

24. Broadly speaking, the functions of this national information grid system would be to -

(a) strengthen the information base in the existing organizations,

(b) assist in setting up new information units or cells, from the sources,

(d) orient to information management at the source by appropriate feed back measures; avoid duplication with and between other organizations and establishments; ensure collection of data and processing of such data at the sources to meet the users' ultimate end objectives.

(e) <u>disseminate processed information to meet the users' requests, whether in the private or public sectors</u> of the economy, for e.g. status reports on important areas of S & T, industrial products, raw materials and universal products, agricultura commodities,

(f) ensure that information management is progressive and based on the latest available technologies, equipments, methodologies, etc.

(g) ensure that data and information processing is based on a scientific approach and thus reliable, accurate and most recent.

25. The entire national information grid has to be so organized as to be aggressive i functioning. The organizational structure, staffing and personnel policies, public relation system, accounting and administrative procedures, accountability etc. have to meet the requirements of a modern, progressive organization of the commercial type rather than be a Government department with its rigid and inflexible rules and procedur At the same time in their approach to working they should not be patterned on a uni-versity/research organization type which is oriented to intellectual activities in a closed autonomous atmosphere.

26. Charged with the responsibility of implementing a national information policy to meet the requirements of a developing economy, the tasks both in quantity and quality could be quite voluminous and complex for the proposed grid; even at a conservative estimate we could imagine an infrastructure to emerge comprising of a dozen large computer systems at work at the regional levels and the Centre besides a large number of scientists, technologists, engineers, social scientists etc. covering a wide range of disciplines pertaining to science, engineering, technology, social sciences, commerce, trade, economics etc.

Information Management - Need for Study

27. There is a need for critically examining the various aspects of organizing the technological information system in the country. The task could be undertaken in three phases.

Phase I : Collection & collation of factual information.

Phase II : The software and hardware problems: co-relation to organisational structures: evolving two or three alternative systems of management, with projections for cost benefit analysis as also cost effectiveness evaluation.

Phase III : Decisions and recommendations by the policy making body of the Government for implementation of the issues by the various Government, semi-Government and other agencies: evolve a national information policy.

28. For Phase I, the Department of Science & Technology of the Government of ndia as the nodal Ministry could authorise undertaking studies within a time targetted ramework of 12 to 15 weeks each. These studies could preferably be taken up by Committees constituted with whole time members for this task or through consultancy gencies. The specific terms of reference to be investigated could be drawn up and hey could be given a financial support to submit the recommendations within scheduled lates. Some of the aspects on which studies could be carried out and reported on re -

(i) The information sources established in the country: (the publications brought out, the agency concerned, their infrastructure, their charter of work, scope of nformation collected etc).

(ii) Processed information requirements of Government, quasi-Government and rivate sector agencies in the country.

(iii) The feasibility of a mechanized system for collection, storage, retrieval nd reproduction.

(iv) The type of organizational structures for a National Information system, heir scope and results achievable.

(v) Training/staffing problems of information processing, including type of acilities, personnel policies, easy mobility etc.

9. For Phase II, based on these study reports (obtained within a period of three four months), a high powered committee could be constituted, comprising of repreentatives from the industries (including the computers and reprographic group) inance, Electronics Commission, DST and some of the 'management' institutions ke the Institute of Public Administration, Administrative Staff College, NPC, NITIE tc. This committee could undertake the task of drawing up alternative organizational tructures.

0. Phase III of the work could be based on the recommendations of the high owered committee and the NCST/the Sub-Committee of the Cabinet for Science &

Technology could be policy making bodies. The Department of Science & Technology then could process the administrative aspects of the implementation, through the Cabinet Secretariat, if necessary.

Conclusion

31. When implementing the Science and Technology Plan as a part of the Fifth Plan programmes, an appropriate system for information management is essential and as such a decision on the various aspects of this problem has to be taken before the commencement of the Fifth Plan. It would be preferable to organize ourselves throug a three phase programme at least by the first year of the Plan; this means roughly a 3 month target from now to examine the various aspects, consider alternative proposals and implement the recommendations thereof. Some of the salient aspects of the problem discussed in this paper are -

(i) Appropriate information management for scientific and technological efforts has attained a critical state for our country today. There is need to examine all facets of information management and to define our national information policy.

(ii) It is essential to eliminate the vertical and horizontal gaps in the informati requirements of various users and institutions.

(iii) There is need for a national information grid which would enable linking up of the data and information collected by various sources in the country and permit an interflow of information to meet the requirements of users, viz. the Central and the State Governments, the scientific laboratories and institutions, the establishments in th private and public sectors in the fields of industry, agriculture, trade, commerce etc.

(iv) Information management has to be modernised and emphasis has to be laid on a mechanized system for collection, storage, retrieval and reproduction.

(v) Stress has to be laid on processed information through the national information grid while the scientific and technological information collected at the sources would be geared to meet the vertical needs of respective organizations.

(vi) A model organizational set up for a grid system has been suggested; it is only indicative and not necessarily comprehensive. The needs of a region need not be repetitive but could be complementary; the organization could be sufficiently flexible to meet the end objectives rather than a rigid charter for the sake of having one.

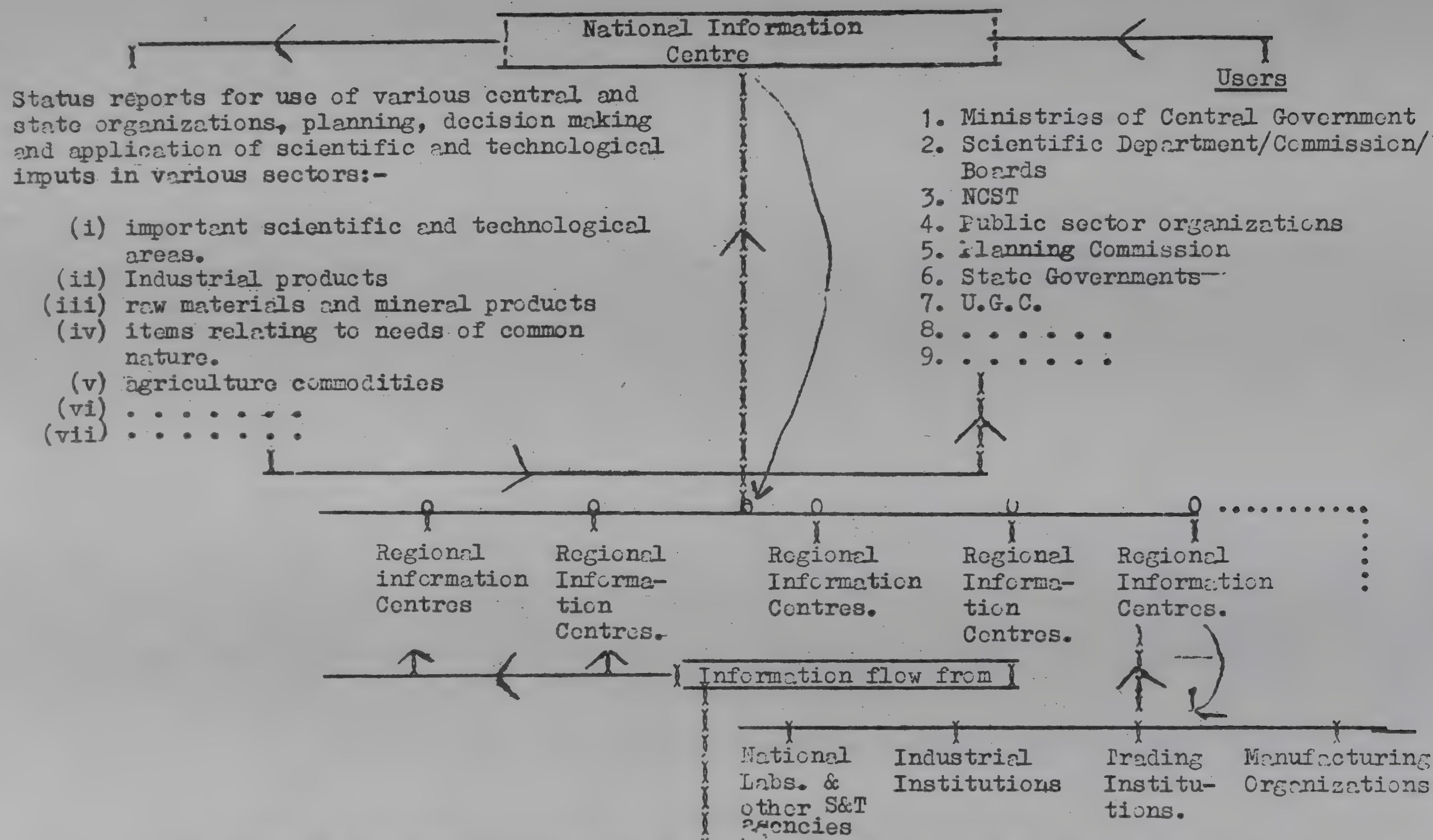
(vii) The manpower needs of such a national organization for information has to be appropriately visualized so that the qualities of trained personnel for this purpose are oriented to meet the requirements of -

(a) a national policy geared to the development programmes,

(b) various processes of Governments at all levels, and

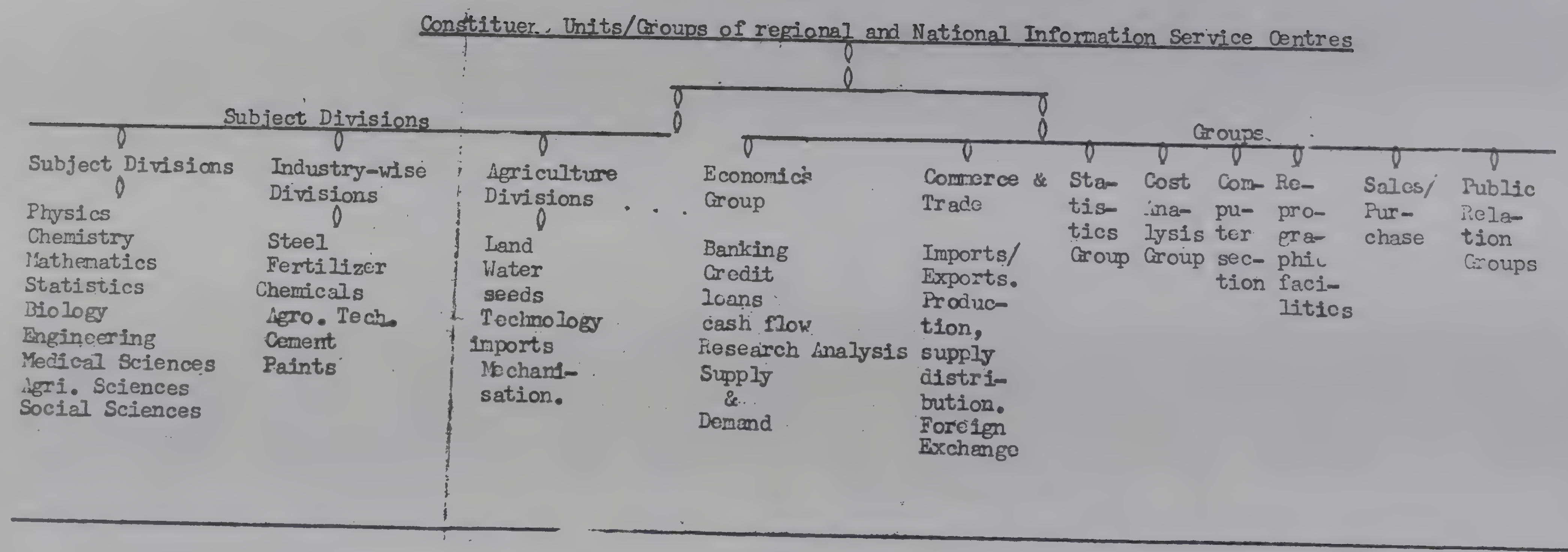
(c) the needs of a scientific and technological policy.

Chart I



1. Regional Ministries/State boards and organizations about needs of the region.
2. Small scale and medium scale industries in respect of local raw materials, mineral products etc.
3. NSS/CSO Units regarding their studies.

Chart 2.


Constituent Units/Groups of regional and National Information Service Centres
Subject Divisions
Groups
Subject Divisions
Physics
Chemistry
Mathematics
Statistics
Biology
Engineering
Medical Sciences
Agri. Sciences
Social Sciences
Industry-wise Divisions
Steel
Fertilizer
Chemicals
Agro. Tech.
Cement
Paints
Agriculture Divisions . . .
Land
Water
seeds
Technology
inports
Mechani-sation.
Economics Group
Banking
Credit
loans
cash flow
Research Analysis
Supply & Demand
Commerce & Trade
Imports/ Exports.
Produc-tion, supply
distri-bution.
Foreign Exchange
Sta-tis-tics Group
Cost Ana-lysis Group
Com-pu-ter sec-tion
Re-pro-gra-phic faci-litics
Sales/ Pur-chase
Public Rela-tion Groups

PAPER B-4

NATIONAL INFORMATICS CENTRE

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Introduction

The raw material for decision making in general, and policy making in particular is information. But the type and quality of information that is processed and its effective use is often limited.

Policy making can be defined as a process where information generated and/or used in one context is revaluated in a different context in order to formulate and/or implement alternative policy decisions. The major problem with contemporary public policy making is the constantly widening gap between what is needed for policy making and how it is actually made.

In order to catalyse better policy making, there is a need to develop central competence in Government, closely associated with a central planning machinery and the financial and manpower controls and in a position to advise the Government on manifold policy aspects. This need has been increasingly felt over the last few years.

Recognising this fact, the Electronics Commission has suggested setting up a National Informatics Centre at Delhi, to evolve an interdisciplinary approach to national planning and decision making as well as for development oriented projects.

2 *NIC Objectives*

Information systems for planning and control of resources and providing a framework for decision and policy making have always existed in some form. But the difficulties involved in obtaining relevant information at proper time have increased considerably with the growth of the economy.

The project NIC aims at contributing substantially to the streamlining of information base in central and state governments. The major objectives of the centre are as follows.

1. Establish and operate a National Information System in support of Government planning, policy formation and management planning period;

2. Maintain a focal point for such activities and to coordinate data handling on the national level and maintain inventories of available data bases;

3. Operate appropriate computer systems in support of the functioning and utiliza- tion of National information system;

4. Maintain and further improve the data management systems related to softwar for national information systems;

5. Participate in the formulation of policies and decisions in the context of nationa information systems.

To achieve these objectives , the NIC has outlined three projects which are of national importance - namely Information System for Agriculture Sector, Information System for Science and Technology and Information System for Manpower.

A brief description of the national projects on cultivator information, science and technology information and manpower and higher education system, the spin-off from these projects is given below:

21 *Project on Information System for Agricultural Sector*

During the Fifth Five Year Plan it is proposed to intensify the green revolution programme in all the states of the Indian Union. The importance of an information system for Agriculture Sector has been keenly felt as the Indian cultivators are dependent upon natural phenomena like monsoon to a considerable extent.

This project would be a national project with the participation of Planning Commission, Indian Council of Agricultural Research, Central Water and Power Commission, India Meteorological Department and Jawaharlal Nehru University. The complete responsibility of the project would be that of the Government of India.

22 *Project on Information System for Science and Technology*

A Science and Technology information system is expected to be grown in several organisations. The broad objectives of this project are:

i) Provision of national information system on science and technology

ii) Optimum utilisation of existing information services and development of new ones.

The data bank is designed primarily for those associated with planning, coordination, execution and monitoring of science and technology development in the country at the highest level. It would provide input to those involved in related planning functions like industrial, educational policy,etc.

It should be emphasized again that this project is subsidiary to many other information systems that may be built around smaller systems in different parts of the country. The only departure, and an important one, is that because of availability of a larger system a focus for the analysis of correlated data structures can be implemented effectively.

23 *Project on Information System for Manpower*

The changing role of the university in the present day requires the use of an information system which is comprehensive, multipurpose that would be broadly compatible among institutions of higher education. There is an increasing need, both for colleges and universities themselves to have up-to-the minute, accurate, statistical data concerning the activities of the colleges and universities. So it is planned to devise and test systems of measuring all fields of university activity - such as instructions, research, public service - involving data about manpower, students, facilities and finance. It will also cover all major components of the university and different colleges and research centres. Such an information system can be utilized for

a) day-to-day operations of the university and its various parts;

b) general reporting which aims at a description, at least quantitatively, of the "state" of institution or of education generally in a state or in a region or in the nation; and

c) the educational decision making, from the simple and rather immediate administrative decision within the university, through the gamut of projection and planning, to the adoption of long range national strategies for education.

24 *Spin-off from the Projects*

A very important spin-off from the projects is the possibility of training a large number of computer oriented specialists in the areas of data bank management and computer aided decision making. It is anticipated that over a five year period starting from 1974, JNU will generate at least 100 high level system software specialists and 150 application software specialists and about 2000 students with a working knowledge of computer software.

There are a number of Government organizations in Delhi, which have information and planning problems,who may graduate to computerization towards the end of the Fifth Plan. The expertise built at National Informatics Centre at Delhi through these projects will assist a smoother transition of these organisations toward computerization.

The U.N. Expert team, headed by Dr. Erling Dessau, Deputy Director, Management Information Services Division, Bureau of Administration and Finance, United Nations Development Programme, New York has made these following comments about the NIC project:

> "The Planned computer project for the JNU, NIC is perhaps the most interesting of the 3 proposed projects to the extent that envisaged research and development activities are 'pioneering', not only for India but for many countries. There is, most likely, a great need for handling massive data files, consisting of social and demographic, as well as geographical, agriculture, metereological, natural resources and metallurgical information and for carrying out correlational studies. The project at JNU NIC for supporting government planning and government decision-making, together with creation of a better understanding of multiple nature of physical and social events, is certainly the type which is entitled to be considered for possible international cooperation".

3 Conclusion

The establishment of NIC is a necessary step but certainly not sufficient one. Techniques have to be developed, and much thought has to be devoted to the question of interaction with the local bureaucracy in order to ensure the success of the NIC.

The evaluation of our effective central computing competence in Government is dynamic process which must be related continuously to the changing circumstances and, in particular, to the growing competence of the computer-using departments, and to the increasing availability of highly professional support services from the software industry. There is a considerable advantage in the concentrating, as far as administrat vely practicable, most of the central functions in one unit and not spreading them over several departments. Rationalisation in this way concentrates expertise, improves communication, sharpens responsibility and reduces the points of contact between the centre, the computer-using departments and the industry. The axioms should be simplicity, clearly defined responsibility and line of communication; the objectives to maximise direct contact between the user and his advisory and support services.

Paper B - 5

NATIONAL INFORMATION SYSTEM FOR SCIENCE AND TECHNOLOGY

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Information as a National Resource

Scientific and technological information is an important resource for accelerat-ng national development in all sectors and at all levels. National governments are ecoming more and more aware of the importance of information as a national resource. The rapid growth of information and the increasing number of people who require infor-nation demand the development of a suitable national information system on a priority asis. Even the most advanced countries have realised this need. Even though they ave a large number of information centres, and services, they find it imperative to volve a national system to maximise the use of their information resources. USSR and number of socialistic countries have set up well-integrated national information sys-ems. France, Federal Republic of Germany, United States, Canada, Australia and apan are also engaged in the organisation of suitable integrated national information ystems to suit their needs. In India, the Science and Technology Plan recognises the eed for developing a national scientific and technical information system on a priority asis.

2 *Existing Facilities in India*

There are nearly 1,000 information centres in India covering the various fields of science and technology. A variety of information centres, with differing functions, scope and efficiency, are distributed over a large number of science agencies, research aboratories, universities, institutes of higher learning, professional colleges, pro-essional associations, government departments, public and private sector industries and R&D organisations. The information facilities in these organisations are intended o meet the local needs of scientists, engineers, research workers, technicians, policy makers, industrialists, etc. There is a great variation in the level of develop-ment of these centres. It should therefore be the main objective of a national infor-mation system to interlink and coordinate the various information centres and their services into an effective national information network. This would facilitate identifying lacunae in the existing information resources and services. The gaps could then be filled up by augmenting the resources for providing more effective, efficient and rele-vant services. Adoption of compatible national standards and guidelines for information handling techniques would enable efficient flow and exchange of information within the national system. This will also facilitate participation in international information systems. Modern information technology and management techniques could be introduced for improving the efficiency and effectiveness of information services.

3 Organisation

The National Information System would be based on the existing information facilities. It would develop as an integrated national system by making full use of the information potential of the country, by coordinating the activities and by seeking the cooperation of individual information centres, according to well-defined guidelines and divisions of responsibilities.

4 Structure of the System

The functioning of the National Information System would be in several tiers. The present and proposed national centres of information (NCs) in science and technology, medicine, agriculture, defence, science, patents, standards, small industries, social sciences, etc. would constitute the top level of organisation. They are mission-oriented information centres operating at national level. The branch information centres (BCs), which are subject-oriented and providing national services are in the second level of organisation. The local information units (LIUs) forming part of individual R&D establishments and serving the specific needs of the users in their parent institutions, are the lowest level of organisations.

The National Information System is a flexible system, with its components operating under a variety of ownerships and jurisdictions, but collaborating together under the guidance of a coordinating body. What is envisaged is some sort of federation of many scattered and previously existing information centres and libraries and establishing new centres for areas not covered already in order to fill up gaps in information facilities. Where necessary, the existing centres would be upgraded and the facilities augmented. The establishment and maintenance of information centres in the various levels would be the responsibility of the agencies or the institutions to which the information centres belong.

5 Roles and Functions

Some of the functions of national information centres, regional information centres, branch information centres and local information units are enumerated below:

National Information Centres: The national information centres (NCs) are responsible for coordinating, organising, and providing information service at national level covering a wide range of subjects and national endeavours. These mission-oriented centres may have the following functions:

1. Planning and coordination of activities coming under their jurisdiction;
2. Developing and maintaining document collections to serve as national base for documentation and information service;
3. Promotion of cooperative acquisition of foreign information sources;
4. Compilation of national union catalogues of information resources in their respective sectors;
5. Provision of current awareness service of Indian scientific and technological information and of selected foreign information sources either bearing interest to several fields or in fields where BCs do not yet exist;

6. Development and maintenance of data banks, containing data relevant to the activities and to the development of the sector;

7. Providing translation service;

8. Procuring copies of documents on request;

9. Providing reprography facilities;

10. Organising information dissemination services based on their own information resources and data banks, and by using information services available in machine-readable form;

11. Organising education and training facilities in documentation information science, computer science, reprography, translation, etc.;

12. Carrying out and supporting research in documentation, information science, computer science, reprography, translation, etc.;

13. Providing advisory services to RCs, BCs and LIUs; and

14. Developing relations and cooperation with foreign documentation and information centres.

<u>Regional Information Centres (RCs)</u>: The main role and functions of the RCs are as follows:

1. To survey the information sources of the region it serves, and to mobilise and organise the information sources and facilities so as to meet the information needs and demands of the region;

2. To compile, maintain, update and publish regional union catalogues of the document resources;

3. To establish and operate a strong reprographic centre and service for the region; and

4. To procure, on request, documents from within and outside the region.

<u>Discipline/Industry-oriented Branch Information Centre (BC)</u>: The main roles and functions of a BC include the following kinds of information services:

1. Specialized indexing and abstracting services (including SDI) for current awareness purposes;

2. Retrospective subject bibliographies;

3. Subject union catalogues;

4. Information retrieval and service on request;

5. Information on patents, standards, specifications, etc.;

6. Scientific, technical, and economic data service; and

7. Preparation of literature surveys, state-of-art reports, scientific and technological forecasting, and other types of techno-economic and special management information services.

Local Information Units (LIUs): The LIUs are the ultimate recipients of information from the NCs and BCs. An LIU would offer a variety of personalized information services to its immediate clientele of the parent institution. In doing this it would take into consideration the research, development, production, and other work in progress and planned in the parent institution, it serves. LIUs also feed BCs and NCs with information generated in the respective institutions which they serve.

6 *NISSAT*

The Department of Science and Technology of the Government of India is vested with the responsibility of developing a National Information System for Science and Technology (NISSAT) during the Fifth Five Year Plan. Some of the specific objectives of NISSAT are as follows:

a) Information Resources Development

i) Allocation of responsibility to institutions for building strong collections in specialised subject-fields;

ii) Ensuring that there is in the country at least one accessible copy of every worthwhile scientific publication for use by specialists, policy makers, etc.;

iii) Establishment of data-banks for scientific, technical, environmental and socio-economic data;

iv) Establishment of regional depositories for storing materials culled out from service libraries and information centres; and

v) Collection of information about specialists and experts in different subject-fields who may serve as useful sources of information and as consultants.

b) Identification of information users

i) Identification of the present and potential users of science and technology and management information.

ii) Creation of information consciousness among science, technology, industrial, business, and management personnel.

c) Providing Information Services

i) Establishment of a national lending library service;

ii) Establishment of a national referral centre;

iii) Provision of translation facilities in various languages;

iv) Provision of adequate reprography facilities and the promotion of the use of reprograph copies;

v) Provision of adequate computer facilities for fast information access and retrieval;

vi) Establishment of subject-oriented national information grids with adequate communication facilities;

vii) Cooperation with other national, international organisations engaged in information and/or related type of services; and

viii) Developing of necessary tools, techniques and services adequate to meet users' information needs and demands, as these change from time to time.

d) Manpower Development

i) Building up expertise and provision for education and training for adequate number of professional personnel of different categories in library science, information science, communication, computer science, reprography, and translation;

ii) Supporting projects in library science, information science, communication, computer science, etc.;

iii) Supporting research programmes in library science, information science, communication, computer science, etc.;

iv) Sponsoring conferences, symposia, seminars, workshops, etc., in library science, information science, communication, computer science, etc.;

A number of programmes will be initiated in the following areas for the development of the National Information System:

i) Survey of existing resources and programmes for strengthening them;

ii) Identification of users and their information needs;

iii) Organising the existing resources and facilities into a structured system to meet the information needs;

iv) Identifying problem areas to be tackled in the development of a national system;

v) Training of manpower at various levels and supporting research in information field;

vi) Application of modern technology for information handling;

vii) Application of standard practices, procedures and formats for information handling;

viii) Establishing links with international systems and their utilisation for augmenting national resources; and

ix) Preparation of an implementation plan giving a phased programme for developing the National Information System.

PAPER C-1

INFORMATION FOR THE SMALL INDUSTRIES IN INDIA

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1. *The Small Industry in India*

Small scale industry has a strategic role to play in all developing countries, since it has potential for high employment and is amenable to dispersal thus bringing about balanced regional development. However, small scale industries are not likely to be able to make their full contribution to economic growth unless appropriate measures are taken to help them overcome the disadvantages of smallness.

In independent India, the importance of cottage and small-scale industries to the economy of the country was realised quite early. To accelarate the growth of small scale sector, the Government had started various developmental facilities such as technical assistance and advisory service, machinery on hire purchase, factory space in industrial estates. credit facilities on liberal terms, marketing assistance, etc. Because of the impetus provided by the various assistance programmes, the small industry in India, in the last decade and a half, has steadily grown in size and diversity.

The phenomenal progress made by the small scale sector during the last fifteen years will be apparent from the following figures: At present the small-scale sector represents more than 90% of industrial units, accounts for 41% of the total industrial employment and 35% of (gross) production. The items produced in the small-scale sector ranges from such simple items as beads and buckets to such sophisticated items like electronic calculators. Small industry in India is thus truly big!

2. *Need for Information*

It has been recognised that to help small scale industries to keep pace with the latest developments in the world of technology and assimilate the results of latest research work being done in India and abroad, it is necessary to devise an organisational machinery for the collection, compilation and dissemination of results of technological and management research. Small scale industries also need assistance in identifying and adopting appropriate and or low capital technologies which are at the same time consistent with economy, efficiency and quality. Hence, in the report "Small Scale Industries Programme of Work for the Fourth Five Year Plan" (Development Commissioner, Small Scale Industries, New Delhi, 1968), it was suggested that a Small Industry Technical Documentation and Communication Centre may be set up.

3. *Nature of Industrial Information*

The basic objective of an industrial information centre is to promote industrial growth. Its first task is to identify its clientele, ascertain their information needs, and then build up a document collection based on the identified needs. Next the documents should be systematically scanned to locate the information for future possible use and to organise this information for easy retrieval. Lastly, and this is most important, it is necessary to promote an intensive utilization of knowledge thus gathered. It may be mentioned here that industrial information is not a substitute for the skill and experience of the technical or the commercial members of an enterprise; rather it can only update technical or scientific skill and commercial experience.

Information on various aspects of small scale industries is sought not only by the small scale entrepreneurs but also by member of government and non-government agencies for planning the programme of development of small scale industries and its implementation. Various types of users of industrial information may be grouped into the following categories:

1. Industrial enterprises and enterpreneurs;
2. Managers, administrators, engineers and technicians in industry;
3. Private and public investors including bankers and other financial institutions;
4. Government departments, including semi-government and other institutions like Industrial Development Corporations, Productivity Councils, etc.
5. Research Institutes;
6. Technical vocational training institutions; and
7. Other national and international organisations.

4. *Type of Information in Small Scale Industries*

The type of information which is often sought by small scale entrepreneurs varies from a very simple piece of information as to what could be a profitable line of production to information on such complex problems as competition in the international market, latest techniques of production, the use of sophisticated and intricate machinery etc. By and large, the type of information required both by individuals and institutions may be summerised as below :

1. Facilities available under the S.S.I. Programme;
2. Scope for new industries in a given area;
3. Scope for manufacturing new products;
4. Industries that could be started in a given investment range;

5. Assistance available from various Government agencies and the procedure for obtaining such assistance;

6. Marketing facilities for small industry products;

7. Marketing intelligence such as names of dealers in particular product lines, off-take of specific items of manufacture, prices of different brands of a product available in the market;

8. Procedure for registration of small scale enterprises and the benefits accruing therefrom;

9. Procedure for obtaining import licences;

10. Factory accommodation in Industrial Estates, their availability and procedure for applying for the same;

11. Machinery and equipment required for a particular line of production or servicing - their prices and suppliers-procedure for hire-purchase of machinery;

12. Details of raw materials required for the manufacture of a particular product, their source of supply, prices or where they are scarce the substitutes that can be used;

13. Technical know-how for a new product-procedure for obtaining foreign collaboration;

14. Patented processes developed by the various laboratories which could be exploited by new small enterprises and the procedure for obtaining such processes;

15. Details of prospective (a) import substitution or (b) ancillary industries;

The above, which is by no means an exhaustive list of the varied nature of information required by/for small industries, gives an insight into the range and complexities of industrial information, especially for small industry. Information is necessary for the definition of the policies and objectives of industrial development. It is also used by governmental and other agencies actively engaged in the promotion and development of industry. The industrialists or industrial entrepreneurs require information at two distinct stages. The first stage is that of preinvestment information - that is, information which will determine an entrepreneur's decision to invest or not to invest. The second stage is that of Current Operational Information - that is, information in support of the day-to-day decision making necessary for the proper functioning of the enterprise. Industrial information involves both macro-economic and micro-economic considerations including technological factors. Industrial information is, thus, quite distinct from R & D information and in much more wide based, hence, more complicated.

5. *Increasing Demand for Industrial Information*

The importance of information in industrial development has been borne out time and again in the past and is today a matter of course in industrialised countries. It cannot, therefore, be ignored by the developing countries. The Panel on "National

Information System" which discussed the "Approach Paper on the Science and Technolog Plan" in New Delhi on 21-23 May 1973 pointed out that "In a country with so large a number of small and medium-sized enterprises - often cut off from all sources of information - it is essential that the industries are provided with easy access to scientific and technical information, if they are to develop and contribute more actively to the national economy. The industries have to be first of all convinced that they need information. Then, they have to be helped to find relevant information. Finally, they have to be advised as to how best to apply the information. Here again, the industries would require information in a manner in which it could be starightway assimilated and made use of. Mere supply of raw scientific information would be of no avail to them. They are more in need of practical know-how, in techno-economic context. The information to be served has to suit their practical needs. For example, providing information about a manufacturing process for which raw materials are not easily available in the place of location, is of no consequence. Most of our small and medium-sized industries do not employ qualified persons and they are not in a position to use raw information. The information to be served has to be well digested and capable of being applied directly towards practical ends."

The tempo and success of information activity is determined by the degree of intensity and sophistication of the industrial and social environment. Before independence India had hardly any industrial activity worth the name. After independence a number of big industries were set up in India. Since most of the industries set up had foreign collaboration arrangement, very few of them felt the need for a fully equipped information centre. Some of them, who have R & D departments attached to the production establishements, generally have well equipped information centres. Special mention may be made of the information cells attached to the Hindustan Antibiotics, Hindustan Machine Tools, and Fertiliser Corporation of India and some others.

There was, however, no documentation or information centre to cater to the information needs of the industrial sector in general. All the documentation services available so far - whether it was INSDOC, the national documentation centre, or the documentation units attached to the various national laboratories or other R & D organisations, were oriented towards the needs of the research workers.

6. *Establishment of SENDOC*

The need for an industrial information centre for small industry was specially felt, when the government launched a systematic and concreted programme for the development of small scale industry. This is because, unlike the large industries, the small units are not in a position to maintain their own information centres. Although a number of organisations like the Directorate of Industries of various states, or the Small Scale Industries Development Organization (SSIDO now SIDO) and its Small Industry Service Institutes and Extension Centres, had been catering to the information needs of the small scale sector on an ad hoc basis, none of them had a regular set up for the systematic collection and dissemination of information. The establishment of the Small Enterprises National Documentation Centre (SENDOC) at the SIET Institute, Hyderabad in 1971, fulfilled this long felt need.

The objectives of SENDOC are:

i) To collect, collate, and store information, data and documents useful for the technological and managerial advancement of small industries;

ii) to disseminate information to the persons or organisations engaged in activities related to small scale industries development; and

iii) to be the national centre for co-ordinating and collaborating with the information activities of other national institutions and effecting liaison with similar centres in other countries.

61 *SENDOC's Services*

SENDOC is thus envisaged as a clearing house of information for the specialised agencies connected with the development and promotion of small scale industries. The Centre collects information on small industry development in all its ramifications - Management: production, personnel, finance, marketing; Technology: Chemical, engineering; techniques and skill; machinery and equipment; governmental and institutional programmes and policies; statistical data regarding types of industries, value added, production, export, employment, capital investment, etc.

The salient features of SENDOC in the five years of its existence have been the building up of an infrastructure of selective resources, competent personnel and adequate equipment with which it is now in a better position to discharge its role as a national centre for the transfer and switching of useful information to persons and organisations in the field of industrial development, with special reference to small scale sector.

SENDOC has been offering anticipatory documentation service through its bi-monthly publication, SENDOC Bulletin, since 1973. Besides, it offers technical enquiry services, microfilming and photocopying service, etc. SENDOC has a rich collection of industrial profiles, which are periodically up-dated. The consultancy division of the SIET Institute prepares on demand new industrial profiles. There is maximum demand for this service. Over the years SENDOC has organised four national seminars in the field of information, which were attended not only by documentalists, but technical personnel from research organisations, industry, and developmental agencies. SENDOC is also conducting training programmes in the fields of 'Information Storage and Retrieval Systems', both for national and international participants. The response to SENDOC's service has been very encouraging, and it has been decided to enlarge and re-orient its services from 1976, to serve the growing clientele more efficiently and effectively.

PAPER C-2

DATA BANK AND INFORMATION SYSTEM FOR SMALL SCALE INDUSTRIES

R. P. Mehta & Dr. W. B Donde

1 *Background*

Since the introduction of the development programmes for small scale industries, the sector has made tremendous progress during the last two decades. The small scale industries have generated substantial capacity of a large variety of consumer and producer goods and its participation in the import substitution programme of the country is noteworthy. Of late, this sector has successfully entered into the arena of production of sophisticated items. In short, this sector is making a significant contribution to the National Economy.

With the expansion of industrial activities in the small scale sector during the last 20 years, all round awareness has developed about the need for comprehensive and uptodate statistical data regarding this sector. Very little attention was devoted so far towards the establishment of a system of collection of basic data regarding this sector on regular and continuing basis. Further, with competition in production between the small scale and the large scale sectors for a large variety of products, the necessity for having uptodate information regarding small scale sector vis-a-vis the large scale is being felt more acutely. Reliable and uptodate data regarding production, employment, investment, exports are woefully lacking. The only organised effort for the collection of data from the small scale sector so far has been through Annual Survey of Industries. The data collected through this survey, though useful, have however, their own limitations and do not cover a substantial portion of the small scale sector comprising units which are not registered as factories.

In view of this need for establishing a system for collection and maintenance of the basic data regarding the development of small sector, the Small Industries Development Organisation decided to set up a "Data Bank Cell" for collection and maintenance of reliable and comprehensive statistical data relating to small scale industries. To provide a base to the Data Bank, a countrywide census of small scale industrial units was launched in 1973-74. The frame for this census was built up from the registration records of registered small scale units being maintained by the Industries Departments of all the State Governments and Union Territories. The data collected through the census, would be updated by the Data Bank through the revised procedure of registration and the system of obtaining annual production returns from the registered small scale units. As both these measures have already been introduced, the mechanism of obtaining data regularly from the registered small scale units has been created.

2 *Information Needs*

The information needs essential for developmental activity in respect of industries in the small scale sector could be broadly classified into the following categories:-

i) Developmental
ii) Technical
iii) Regulatory and
iv) Marketing.

The data on existing capacity, production, exports, employment, investment etc. comprise the first category. These are expected to meet the requirements of policy makers to a considerable extent but would satisfy only a part of the requirements of the individual entrepreneur, intending to set up a small scale industry.

Though information on such aspects as existing production, its dispersal etc. can provide an idea about the prospects of taking up a particular line of industry in a particular area, information on aspects like technical/economic feasibility, process of manufacture, availability of machinery and raw materials, type of testing facilities and their availability etc. and above all on the management aspect are also equally important. Such information could be grouped together under "Technical Information".

An individual entrepreneur has to follow a number of procedures either for setting up or running a unit, e. g. obtaining power load, licence from Municipal/local bodies; registration with the Sales Tax/Excise authorities, export documentation, enlistment in Government purchase programme etc. and all the information will go under the head "Regulatory Information".

The fourth category of information will be on the market and marketing intelligence for a product or group of products. In fact with the rapid advancement in technology and the increasing competition from the medium and large scale sector, the decision for selecting a suitable line of manufacture will largely depend on this background information. Information on total production, demand and supply position, price structure, locational advantages, distribution channels and system, export potentialities, sales promotion and advertisement, packaging, standardisation etc. are of vital importance both for the existing as well as the prospective entrepreneurs.

3 *Organisation of Data Bank*

31 *Development Data:*

The data collected through the National Census, referred to earlier, will form the base on which the superstructure of developmental data is to be built. The major breakthrough has been achieved in this direction. The procedure of registration of the small scale units with the Industries Departments of the State Governments and Union Territories has been streamlined and brought to a uniform footing. Under this procedure the individual entrepreneur or party seeking registration with the State Industries Departments is required to fill in a prescribed form of application incorporating the base line data (data on location, employment, initial investment, type of organisation, type of entrepreneur, etc.) which are not likely to change too frequently. Uniform concepts and definitions in furnishing the information at the time of registration will ensure that inter-state comparisons are valid and reliable. This base line information

from the application forms for Registration is envisaged to be supplemented with the data which would flow through annual returns. The annual return will incorporate data on actual production, capacity, employment, consumption of raw materials, exports, ancillary supplies and also the sales effected during the period under report. The data generated by these two sources will be adequate for erecting the superstructure of developmental data over the base of the census data.

The basic data of the Census have been stored on the magnetic tapes. The updating system for these data will also a computerised one. The basic record on the tapes will be at the level of individual manufacturing units. The updating mechanism will thus involve:-

a) Updating the data on variable items like production, employment, exports, consumption of raw materials, sales, etc.

b) Broadening of the base with the addition of information on units being continuously added to the registration records.

Each individual unit will carry a unique identification number, consisting of code for State & District where the unit is situated and a running serial number which will vary from District to District. This scheme was adopted for computerisation of data from the Census schedules and has been incorporated later on in the format of the registration number to be allotted to the post-Census units. The registration number to be allotted to the units registered after the cut off point of the Census, will essentially consist of State code/District code/running serial number (which will be in continuation of running serial number of the Census). Thus, in future, the registration number of the units itself will be the identification number for the computerised system. The State code and the District codes have been evolved in collaboration with the Directorate General for Technical Development (DGTD) who are also building up their own information system. These identical District/State codes will enable matching of Districtwise aggregates for small scale sector with those of medium and large scale sector.

The implications of allocating a unique identification number to a particular unit are very wide. In any computerised system where identity has to be kept at the level of individual constituent unit, the code to each of such unit has to be allotted for identification purposes on the magnetic tapes or other storage medium. Since registration number of the unit will be used in the records of other organisations like Chief Controller of Imports and Exports, commercial banks, which also deal with the small scale manufacturing units, it would be possible to match the data available with these organisations with the data maintained by the Data Bank of the Small Industries Development Organisation (SIDO) through the common parameter of the registration number. Time is not far off when the above mentioned agencies may switch over to electronic data processing and in that situation it would not only be feasible to exchange the data tapes between each other but such exchange will also provide sufficient material for evaluating the reliability of the data furnished by the same set of individual manufacturing units to the different agencies of the Government/Financial institutions in pursuance of various acts and regulations, directives etc.

A system of regular flow of the data from the District Industries Officers and the individual manufacturing units to the Data Bank of the SIDO and feedback from the latter to the Small Industries Service Institutes and Directorates of Industries is in the process of being established.

The Data Bank at the headquarters of the SIDO will maintain information both at micro & macro levels through a suitable computerised system. The feedback to the SISIs will be the information at macro or micro level in respect of the States under their jurisdiction. The Small Industries Service Institutes (SISI) will maintain information relating to names and addresses of the units productwise, on suitably designed index cards. The index cards will have the provision for incorporating the details like capacity, production, employment investment and details of machinery and equipment. Besides enabling the SISIs to furnish the information needed by the entrepreneurs, the data thus maintained will also be useful to the technical officers for preparation and scrutiny of model schemes and project reports.

At the first phase of programme of work, the system of flow of data as detailed in the foregoing paragraphs will be put into operation and efforts will be made to perfect the same. In the absence of any statutory obligations for the small scale units, to furnish the data periodically to the State Industries Departments, the task of establishing regular flow of these annual returns is beset with numerous difficulties, and it would entail lot of financial and human resources to achieve a definite success. A number of recommendations for strengthening the State level organisations are under consideration of the Government in this regard and it is expected that some headway will be made in building up the information system, both at the State levels and the SIDO headquarters by implementing these recommendations. What is more important is that conscious and determined efforts are to be made for evolving a system of maintenance and dissemination of developmental data relating to small scale sector. It is also envisaged that an Index of Industrial Production in the small scale sector on annual basis, would be built up.

32 *Technical Information*

As already indicated, the individual entrepreneurs often need technical information, in addition to developmental information, right from the proposal stage to actual setting up of a unit and running it on efficient and profitable lines. The technical information may relate to :-

i) Feasibility studies
ii) Schemes and project reports on selected items
iii) Testing facilities
iv) Common facility services
v) Prices of various items of machinery and raw materials and the sources of availability
vi) New products and processes being developed for commercial exploitation
vii) Consultancy services and demonstration
viii) Training facilities, and
ix) Research and Development facilities.

Maintenance of this type of information is more relevant for the Small Industries Service Institutes, (rather than the SIDO Headquarters) which are contact points for the SIDO with the small scale units. Some special studies like area surveys, techno-economic surveys, studies on identification of growth centres, intensive campaigns etc are undertaken not only by the Small Industries Development Organisation but by some other agencies also, directly or indirectly, connected with the development of small scale sector. It is intended to keep uptodate information about such studies.

This will not only be useful in avoiding duplication of efforts by different organisations while undertaking such studies but will also afford an opportunity of critical evaluation of the recommendations made in various studies conducted and completed over different periods of time. Though a number of surveys and campaigns are being conducted in different parts of the country and large number of industries are recommended in the reports for setting up in various areas, there has not been any follow up action to ascertain whether such recommendations were implemented and if so, with what results. If comprehensive information about the previous studies undertaken is made available before a fresh survey is contemplated, the question of evaluating earlier recommendations, during the proposed survey could be taken care of.

Collection and maintenance of this type of information is very expensive and requires special expertise. A documentation unit known as Small Enterprises Documentation Centre (SENDOC) is already functioning in the Small Industry Extension and Training Institute at Hyderabad. The SENDOC has developed a well organised system of collection and maintenance of technical information on most of the aspects listed above. The wealth of technical information available with the SENDOC could be used fruitfully by the Small Industries Service Institutes. A scheme for establishing an information grid between SENDOC and the SIDO with its constituents scattered all over the country, is being worked out. The Data Bank at the SIDO headquarters and SENDOC of the SIET Institute will be the two nodes of this information network and a system of continuous exchange of information between the various constituents of the grid will ensure optimum utilisation of the resources and fuller use of the information being collected and maintained.

For maintenance of information on scientific lines Small Industries Service Institutes should have necessary expertise and qualified staff.

33 Regulatory Information

A prospective entrepreneur is normally not acquainted with the existing policies of the Government regarding development programmes as well as the procedures which need to be gone through in setting up a manufacturing unit. He would be saved a lot of hardship and running about, if he is briefed and guided properly in advance. Some of the procedural items in this connection are:-

a) Obtaining approval of industrial power and connection thereof.

b) Licence from local Municipal authorities for carrying out the manufacturing activities.

c) Registration with/clearance from other agencies like Drug Controller, Health Authorities, etc. for certain specific items.

d) Obtaining water connection.

e) Procedure for securing financial assistance.

f) Procedure for obtaining machinery on hire purchase basis.

g) Registration under Sales Tax/Excise Acts.

h) Procedure for obtaining import licence, if relevant.

i) Incentive for export and export documentation.

j) Enlistment for Government purchase programme.

k) Foreign collaboration procedure, if necessary.

The information on the above aspects is no doubt, available, with various departments of the Government (both at Central and State levels), yet there has never been concerted efforts to bring together all at one place so that the same could be disseminated to the needy parties as a sort of assistance in one package. It is considered desirable to collect and maintain this type of regulatory information at the level of Small Industries Service Institute for the benefit of the individual parties. The topics having uniformity at the All India level such as import/export policy, excise, taxation, etc. may well be attended to at the SIDO headquarters and the latest and uptodate information communicated to the Small Industries Service Institutes. The other topics where there are variations from State to State, the Small Industries Service Institutes themselves will be made responsible for collection and maintenance Small handouts incorporating the latest information could be prepared at periodical intervals to facilitate the process or dissemination of information.

34 Marketing Intelligence:

Of late, marketing has emerged as one of the foremost problems being faced by the small scale industrial units. Areas where there is stiff competition from medium and large scale sector, the small scale units are distinctly at a disadvantage as their capacity to incur substantial expenditure on publicity and other sales promotional measures is very limited. At times some units have, perforce, to close down, being unable to find regular outlet for their products. This results in infructuous investment on the part of the individual entrepreneur as also the financial institutions and other Agencies who get themselves involved as a result of their promotional efforts for this sector.

Enlistment of small scale units under the Government purchase programme and opening of sub-contract-exchanges have been brought into being to help the individual manufacturers in marketing their product. But these alone are no longer sufficient to mitigate the hardships faced by the manufacturers. Marketing assistance is to be clearly distinguished from marketing intelligence. While the former relates to physical help in disposing of the products, the latter is a service which the individual manufacturer requires in respect of supply, prices and demand at different market centres. Marketing intelligence is a very broad term implying a variety of information needed for marketing and marketability of the products. It may comprise:

a) Information about the distribution channels -- whole-sales, retail sales, Government supplies, ancillary supplies, exports etc.

b) Price mark-ups at different stages from the factory gate to the ultimate consumer.

c) Market prices of different brands - whole sale, retail sale.

d) Marketing practices.

e) Facilities like after-sale services.

f) Demand and supply position.

g) Substitutes.

The marketing intelligence collected from the field is to be supplemented by the information available from secondary sources. It may not be desirable to cover all the products for introducing a system of collection and maintenance of marketing intelligence as it would involve huge staff for collection and compilation of data. The products where the problem of marketing is very acute could be selected and efforts made to supply marketing intelligence to the needy parties. Information on some of the aspects mentioned above, is collected though not on a systematic basis, by the SIDC while conducting area surveys and other special type of studies like impact of reservation, prospects of an industry, etc. Lot of planning and considerable amount of investment is, however, necessary to evolve a system of regular collection, maintenance, and dissemination of this type of information to the entrepreneur. Other agencies like Trade Development Authority, NSIC, State Small Industry Development Corporations are also gathering some information. Coordination between the various agencies and exchange of available data will lead to considerable economy in expenditure.

4 *Phasing of Programme*

Building up of Data Bank is a slow process and has necessarily to be suitably phased. In the first phase, a system of flow of developmental data from the individual units has to be put on sound lines. This will entail considerable efforts on a sustaining basis for which close collaboration between the Centre and the States will be an essential prerequisite. This phase of action has already taken a start. A proposal is under consideration of the Government regarding enactment of legislation for the small scale sector. This will provide legal backing for collection of statistics from the small scale units. The second phase will be the establishment of information grid at each of the SISI level with the active participation of the SENDOC of the SIET Institute. The third phase will relate to introduction of a system of collection, maintenance and dissemination of regulatory type of information. It will not be prudent to confine attention only to the first phase and wait till the same, more or less, gets going before embarking on the next phase. Resources permitting, the second and the third phases could also be taken up concurrently. As for marketing intelligence, it is too early to say as to when it would be possible to make a beginning.

The Data Bank, when fully developed, will function as a storehouse of information essential for the development of industries in the small scale sector. One can think of creating 'Product Profiles' under which all information pertaining to a particular product or indirectly relevant to it, is brought together at one place. The product profile may comprise information on:

a) Existing units in small/large scale sector.
b) Capacity/production in the small/large scale sector.
c) Demand and supply position.
d) Policy regarding its development-reserved, priority, not to be encouraged categories etc.
e) Whether covered under Excise Act, ,if so the rate of Excise duty.
f) Type of machinery required.
g) Availability of schemes and project reports.

h) Feasibility studies, if conducted.
i) Raw material requirements.
j) Marketing channels.
k) Prices - whole sale, retail.
l) Exports and imports.

A selective approach might have to be adopted as it may be neither possible nor desirable to cover all the products running into more than four to five thousand which are being manufactured by small scale industries. Initially, such type of profiles could be maintained in folders arranged in alphabetical order or in sequence of product codes. But ultimately it would be advantageous to transfer the data on to the magnetic tapes or even better, on magnetic disc, (a storage medium with random access feature) for much quicker retrieval.

5 *Looking into the Future:*

Electronic data processing is gradually catching imagination of various agencies in the Government sector. Where huge mass of data is to be processed involving updating of a large number of individual records at frequent intervals, computerisation is the only resort, provided accurate inputs are ensured in time. If at the time of carrying out this transformation, concerned departments collaborate with other departments having computer facilities, it would be possible to dovetail the requirements of other organisations at the initial stage and introduce some common parameters through which basic data could be exchanged on EDP system. To cite an example, registration number of small scale units could be interconnecting link between the basic data to be maintained by the SIDO, commercial banks, Office of the Chief Controller of Imports and Exports as one group. Commodity codes could be yet another common parameter through which exchange of data might be feasible between the SIDO, DGTD, DGS&D, etc. The Department of Statistics, Government of India, are in the process of bringing out 'Product Classification' codes which could be adopted uniformly by all concerned. Time has come when some serious thought has to be given to evolve a system whereby export from the small scale sector could be tabulated by the Director General of Commercial Intelligence and Statistics every month. No doubt, a series of documents will need modification and a number of hurdles might have to be overcome, yet the task is by no means unsurmountable, if the concerned Departments could get together with a will to find out a solution to this problem.

PAPER C-3

ENGINEERING INFORMATION NEEDS AND SERVICES

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1 *Engineering Information*

Engineering finds an optimum solution to convert the abstract into concrete giving due weightage to all the parameters involved whether these are in scientific, technical, economic or social fields. A Good Engineer has necessarily to take into account simultaneously all such parameters which influence the final engineering decision. In doing this the Engineer acts as a convertor of available resources into meaningful and concrete wealth in the form of goods or services for the benefit of the society. An engineer is essentially the Manager of Man, Materials, Machinery and Money (the 5 Ms). An important input in the Management which properly binds these 5 Ms is "information" of the right kind at the right time in the right dose. Unlike scientist whose main preoccupation is in the furtherance of knowledge and in the generation of new knowledge, an engineer's main preoccupation is in creating material objects or purposeful services by utilizing such available knowledge as the engineer might need in a given situation.

Broadly speaking, therefore, scientific information, engineering information and management and social sciences information can be viewed as three distinct spheres of information, though one may overlap the other in certain respects (Ref. Fig. 1). Whenever we talk of engineering information, we refer to the central sphere which is contiguous with the scientific information on the one side and the management and social sciences information on the other; some aspects have naturally to overlap.

2 *Magnitude of the Problem*

It is estimated that 30 million technical books already on the shelves are being expanded at the rate of almost 600 a day; in addition, about 1, 00, 000 special journals are published every year - 35 percent of them carrying some three million articles dealing exclusively with science and engineering. By extrapolating growth rate of technical literature it may be conjectured that by the end of the present century the total number of scientific and engineering journals published would reach nearly one million. Thus the system of collection, compilation, translation and transmission of information published in millions of scientific and engineering papers, books, journals, conference proceedings in hundreds of different disciplines and in many languages is perhaps one of the most difficult tasks in the development and transfer of science and technology.

But an engineer's needs extend even beyond what is provided as information in this form and so the problems become even more complicated. He should have at his disposal, systems which would, in addition to the above, generate, collect, store, retrieve, interpret and use knowledge available in the form of drawings, specifications, standards, patents, project reports, feasibility reports, construction reports, design development models, photographs, .films, etc.

3 Engineering Information Needs

The broad expanse of engineering information for industry is often underestimated. People who never have worked in an industrial enterprise do not realise the complex and diversified activities necessary to keep a factory running and to make a business a success, to continue uninterrupted service to the community or to construct something. The main sources of failure need not be only the lack of technology, but also may include among other things the lack of cost/benefit analysis, maintenance and market evaluation. Engineering information must, therefore, cover many - and some unexpected - aspects. For example,

a) Raw materials and semi-finished goods as far as used in the industrial processes; world -, regional- and national-production; market situation; quality standards; prices; international and domestic trade; new materials substituting for traditional ones;

b) Economic infrastructure - Possibility of use of indigenous resources, new industrial uses for by-products, public utilities, water and power availability, prices, transportation, rates, capacity, labour, technical education training facilities, trade unions, recruitment.

c) Technology - Process and techniques, technology appropriate to local conditions, machinery, power requirements, innovations, problems of maintenance and repair, performance characteristics, spare parts, service availability, factory design, productivity, automation problems, rationalisation, technical management, quality control, labour requirement.

d) Products - Product design, fashions, packaging problems, quality control, markets, domestic and foreign competition, prices, sales organisation, cost/benefit analysis, export opportunities, supply and demand situations, clients.

e) Suppliers of equipment and formulae for products, including the names and addresses of suppliers, types of machinery available, costs, conditions for purchase, and delivery procedures and schedules.

f) Standardization and Standards, including standardization systems, standards adopted by the industrialised nations, other developing countries and international standards, industrial regulations, testing facilities, specific product standards, and materials specifications.

g) Markets and marketing, including data on present and future markets, international prices and trends, exporters of products concerned, and productivity and production rates of other nations and future trends.

International Engineering Information Services

Whilst a great deal of attention has been given to information services in general n the world, organisation of Engineering Information Services has till now received ess than scanty attention. The international information system UNISIST of UNESCO, rovides an international forum and has planned a programme for the development of n international information system. Even so, the attention, as is evident, has been eavily on non-engineering or non-industrial information aspects of information sci- nce and service.

There are several other international organisations which in their own way have een seized of some aspects of information service or the other. The International ederation for Documentation (FID) is yet another organisation which is promoting hrough international cooperation research in and development of documentation which ncludes inter-alia the organisation, storage, retrieval, dissemination and evaluation f information; the increasing interest of FID in promoting Engineering Information is eflected, amongst others, in the WFEO-FID-CRI project sponsored on the Cement esearch Institute of India. The International Council of Scientific Unions is another ody which addresses itself to the problems of abstracting services in the world of cience and technology through its abstracting agency, ICSU-AB. Similarly, ICSU- ODATA has been busy in the field of scientific and technical data which is perhaps one f the closest activities to engineering information aspects, especially in relation to esign.

Mention may also be made of the International Atomic Energy Agency (IAEA) for uclear information and the International Organisation for Standardisation (ISO) for tandards information. There are several national bodies in different countries which ave been doing considerable work and have had international impact, too. But it is he World Federation of Engineering Organisations (WFEO), through its Committee on ngineering Information, which is making the greatest impact yet in each one of these nternational bodies to get engineering information recognised in its own right so as to rovide for it in their systems.

WFEO has also been trying on its own: (i) to determine the information needs f engineers, (ii) to compile a directory of the presently available engineering infor- mation services in the world, (iii) to develop lexicographic tools of value to engineer, nd (iv) to establish systems and a clearinghouse for engineering data. The industrial nformation Services which have recently been developed by the United Nations Indus- rial Development Organisation (UNIDO) is yet another attempt to meet the information eeds of engineers and industrial entrepreneurs on a global basis.

5 *Engineering Information Services in India*

Most of the engineering information services in India are being rendered by pro- essional engineering societies, such as the Institution of Engineers (India); research and developmental organisations such as, Council of Scientific & Industrial Research, Atomic Energy Commission, Defence Research & Development Organisation, Research Designs and Standards Organisation of the Ministry of Railways, Laboratories under various Ministries, Endowment Research Institutions and R&D units in Industrial Houses. Certain industries have developed their own technical information groups as those which exist in Hindustan Steel Ltd., Tata Iron & Steel Co., Bharat Electronics, Bharat Heavy Electricals, Heavy Engineering Croporation, Oil & Natural Gas Com- mission, Indian Telephone Industries, Associated Cement Cos Ltd., Fertilizer Corpo- ration of India, etc.

6 *Future Plans for Engineering Information Services*

60 The notable amongst the plans for engineering information services in the future are the establishment of National Data Banks and National Information System in Science and Technology (NISSAT) which have engineering information as a component.

61 *National Data Banks*

In the National Data Banks proposed to be established, all types of data - both numerical and descriptive - in respect of aspects such as, R&D activities in all agencies, completed projects for these available for commercial exploitation, status of technology, industrial processes, licenses issued, joint ventures, production,etc., will be collected. These banks will select appropriate information, analyse it with user interests and store it either in a conventional or a machine-readable form.

62 *National Information System in Science & Technology (NISSAT)*

On behalf of Department of Science & Technology of the Government of India, the NISSAT is to be developed with the nucleus of information facilities available in the laboratories of Government Scientific Agencies, public and private sector industries on a total national basis.

Amongst the three tiers of the proposed NISSAT scheme, engineering information services will be mainly rendered by the Branch Information Centres (BICs). The main role of BICs is to provide the following services:

a) specialized current indexing and abstracting services, and Selective Dissemination of Information;

b) subject bibliographies;

c) subject union catalogues;

d) information retrieval on request;

e) information on patent specifications and standards data;

f) information on scientific, technical and economic data; and

g) preparation of surveys, state-of-art reports, scientific and technological forecasting, and other types of techno-economic and special management information service.

With particular reference to engineering information, several areas have been identified for the establishment of BICs within the NISSAT framework. Considerable progress has already been achieved towards developing adequate information base capable of providing national service, in the National Aeronautical Laboratory, Bangalore; the Central Food Technological Research Institute, Mysore; the National Metallurgical Laboratory, Jamshedpur and the Cement Research Institute of India, New Delhi and a number of others. An Electronic Information Centre is already in operation under the auspices of the Electronics Commission.

63 National Information & Documentation Centres

In their programme for establishing a national information network, the NCST assigned the task of evolving framework for such networks in several areas of science and technology, of which the Planning Group on Information and Documentation for Housing and Building Technology has done considerable work. An agency which can provide a comprehensive, systematic and organised service to the Housing and Building Industry in the country is envisaged to be the National Information and Documentation Centre on Housing and Building Technology. The objectives of the centre will include, amongst others, the following within the sector on Housing and Building Technology:

- To act as a national clearinghouse for information in this sector,
- To collect, store, organise, retrieve, translate and disseminate technical literature,
- To bring to the attention of engineers, scientists, architects, etc. engineering information including current practices relevant to their work,
- To maintain liaison with all the related institutes in the world for mutual exchange of information and publications,
- To provide reprographic services,
- To publish relevant periodicals, handbooks, reports, data sheets, training manuals and directories,
- To organise seminars, lectures, conferences, film shows and exhibitions to promote communications of engineering information,
- To maintain a register of R&D activities in the sector in the country,
- To compile and maintain a roster of specialists in various disciplines of the sector, etc.

7 Technology Transfer Interface System for Industrial Information

Technology transfer can take place singly or jointly in a number of ways including dissemination of information through published literature, conferences, lectures, communication media, movement of people, discussions and visits; through the process of standardization; through foreign investments and associated transfer of knowhow; through input of machinery and equipment; through technical cooperation programmes; and through licensing of knowhow, patents and trade marks.

It is well known that for an effective transfer of technology, the transferee should have developed the requisite competence and be equipped enough to receive, assimilate and utilize the new technology by adapting, if necessary, to the transferee's own conditions; the transferer should also be willing and cooperative in this process. In any such system of transfer of technology, actual mechanics can considerably vary from situation to situation but it is now well established that the most important single factor which would contribute to the success of transfer is the creation of proper interfaces in the system. In any given circumstance, every centre of technology has four clear interfaces two in the vertical direction and two in the horizontal direction as illustrated in Fig. 2.

The transfer should be both vertical and horizontal, but what is important is the proper interfacing and a proper linkage, so that the knowhow is transmitted from one level to the next and is absorbed and used. Any effort at transfer without being clear about its interfaces might lead to infructuous expenditure of resources and efforts.

The upper vertical interface takes the inputs and the lower vertical interface delivers the output. At the upper vertical interface, the relatively more fundamental or basic knowledge of information or raw data or the more sophisticated aspects of the knowhow and technology are put in. These are processed in the centre and converted into more readily utilizable forms to be given out as the output. In other words, this vertical transfer results in the pure science or raw data at the top face leading through successive interfaces to more applied forms of technology till finally the last output of technology results in a concrete hardware or a definite usable instrument of service to the society or industry.

In the horizontal direction, one of the interfaces feeds the centre with the scientific, technological, economic and social information generated in one context for application in its own processes and at the other interface disseminates the knowhow which has been generated within itself for application in other contexts.

Whilst this concept of interfacing is a basic one and the philosophy of interfacing is an essential prerequisite in any effective system for transfer of technology, it is not always necessary that the centre for transfer of technology be a separate institution, organization or entity; it is possible to bring about such a transfer even within the framework of a single entity or institution as long as the transfer mechanics is realized as a closed orbital loop in which every link has an interface with the preceding one and the following one.

8 *The Integrated Approach to Industrial Information by CRI*

80 The Cement Research Institute of India (CRI) - the national centre for R&D in cement and allied industries - is a cooperative venture with the active participation of all concerned. The activities of the Institute encompassing the needs of all its constituent participants cover the entire spectrum with cement as the pivotal theme, starting from the raw materials available in nature and their exploitation towards making cement through the manufacturing processes, the design and development of cement plants, the cement technology, the concrete technology, construction technology and finally the concrete structures where cement finds its ultimate place of rest.

81 *Activities of CRI with Particular Reference to Industrial Information Services*

The Management structure of the Institute comprises two distinct structures - the Infrastructure and the Operational Structure. The Infrastructure has three different limbs - the Faculties, the Facilities & Services, and the Management Controls, in addition to which the physical units in which the infrastructure is housed form another part. The Operational Structure, on the other hand, has Technology Generation and Technology Transfer Activities as the two distinct limbs; the independent testing activity forms an additional part in this. Above all, with a view to bringing in a working culture in the Institute which leads to the best utilization of resources put in, there is the Matrix System of R&D management to coordinate all aspects. The crux of the Matrix System is to bring out a conceptual distinction amongst the various activities of the Institute whilst retaining the infrastructural wholeness of the talent, equipment, environment, services and controls, and achieving the objective fulfilment through a balanced integration of these.

The organs of the Institute which have been entrusted with activities relating to the engineering and industrial information have been conceptually designated as the Technology Transfer Sciences Faculty, the Technical Communications Services Division and the Industrial Information Centre. Whilst these three exist as conceptual organs, each and every individual within the Institute is a participant in these organs contributing in the respective field of his specialization. With a view, however, to streamline the working procedure as well as assigning respective responsibilities, the areas of activities of these three organs, as an illustration, are listed below:

811 *Technology Transfer Sciences Faculty*

i) Current awareness techniques including selective dissemination of information.

ii) Performance criteria for information retrieval systems.

iii) Indexing languages, their components and characteristics and other lexicographic tools.

iv) Mechanised information retrieval systems.

812 *TechnicalComm unications Services Division*

1) Keeping the various R&D Groups of CRI promptly informed, of the latest scientific and technological advances, parallel investigations and developments of relevances to the concerned R&D Group.

2) Libary & Documentation

   i) Acquisition of technical literature, cataloguing and classification;
   ii) Maintenance of card catalogue file;
   iii) Preparation of 'CRI Current Contents' and 'Express Current Awareness Lists';
   iv) Compilation of bibliographies;
   v) Assigning keywords and UDC number to 'CRI Abstracts';
   vi) Procurement and maintenance of trade literature file;
   vii) Procurement and maintenance of reprint file;
   viii) Maintenance of newspaper clipping file;
   ix) Procurement and maintenance of patents information file;
   x) Providing translation services to R&D Groups in CRI;
   xi) Acquisition of microfilms;
   xii) Providing reprography services to R&D Groups in CRI;
   xiii) Subscription to periodicals;
   xiv) Maintenance of Kardex; and
   xv) Membership of Professional bodies/Societies

3) Development of Photographic Facilities.

813 *Industrial Information Centre*

1) Keeping the industries being served by CRI informed of the latest scientific and technological achievements, trends and developments of interest and use to these industries;

2) Technical enquiries relating to all the scientific and technological activities of the Institute;

3) Technical liaison through exchange of technical documents, project reports, catalogues, patents, specifications, models, etc.

4) Planning and organization of display centres;

5) Editing, printing and publishing of all CRI publications and the work connected therewith;

6) Providing translation services;

7) Providing reprography services;

8) Maintenance of uptodate mailing list for CRI publications; and

9) Organization of seminars and symposia.

To support the activities relating to engineering information, the Institute has at present about 12,000 volumes including technical books, bound volumes of periodicals, research reports, standard specifications,etc. It is getting over 300 periodicals titles in the field of cement and concrete. In addition, over the years, it has collected more than 2,000 trade catalogues, and reprints. It is also organizing a patent information file. The library is maintaining a Central Information File which is planned to have all the microdocuments indexed, for retrospective search and for compiling subject bibliographies. The pattern of information collected for eventual dissemination revolves round cement as the nucleus.

The Library has also established liaison around the world with similar organizations, for exchange of technical publications. In the NISSAT plan, the Cement Research Institute of India will find a place both at the BIC level and the LIU level.

82 *Quantification of Benefits Accrued from CRI's Engineering Information Services*

The benefits derived through various technology transfer services including technical and industrial information, standardization, training, seminars,etc., since its inception nine years ago, have been estimated to be approximately Rs.40 million.

9 *Conclusion*

In order that the information service becomes really effective, one has to look into the detailed system and endeavour to make it a really integrated one. Indeed, information science has become a science in its own right just like any other branch of science providing answers to how to deal with various situations under various circumstances. Engineering information has its own special components, hitherto not handled by information science experts, such as drawings, models, audio-visual aids and so on. As such, a great deal of attention is called for to work out effective systems to deal with such information aids.

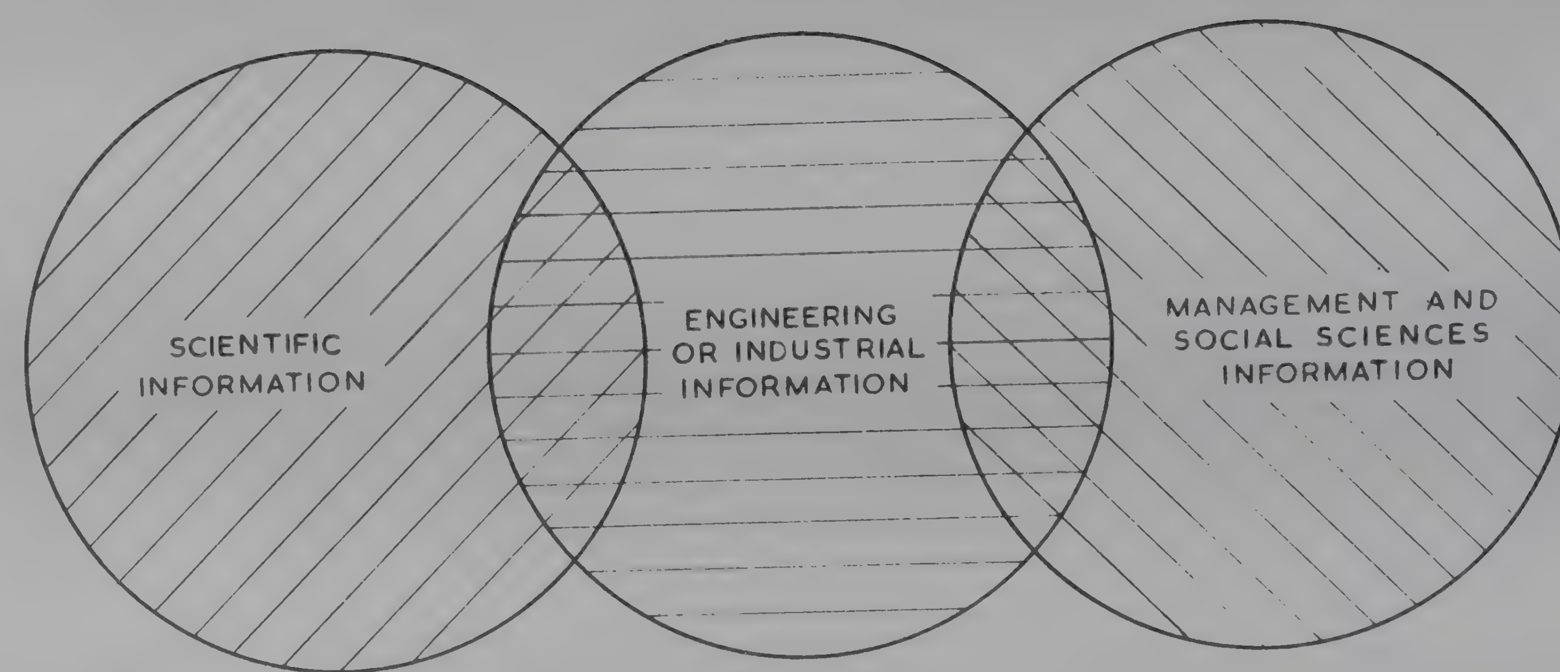

FIGURE 1 SPHERES OF INFORMATION NEEDS OF SCIENTIFIC & TECHNOLOGICAL COMMUNITY

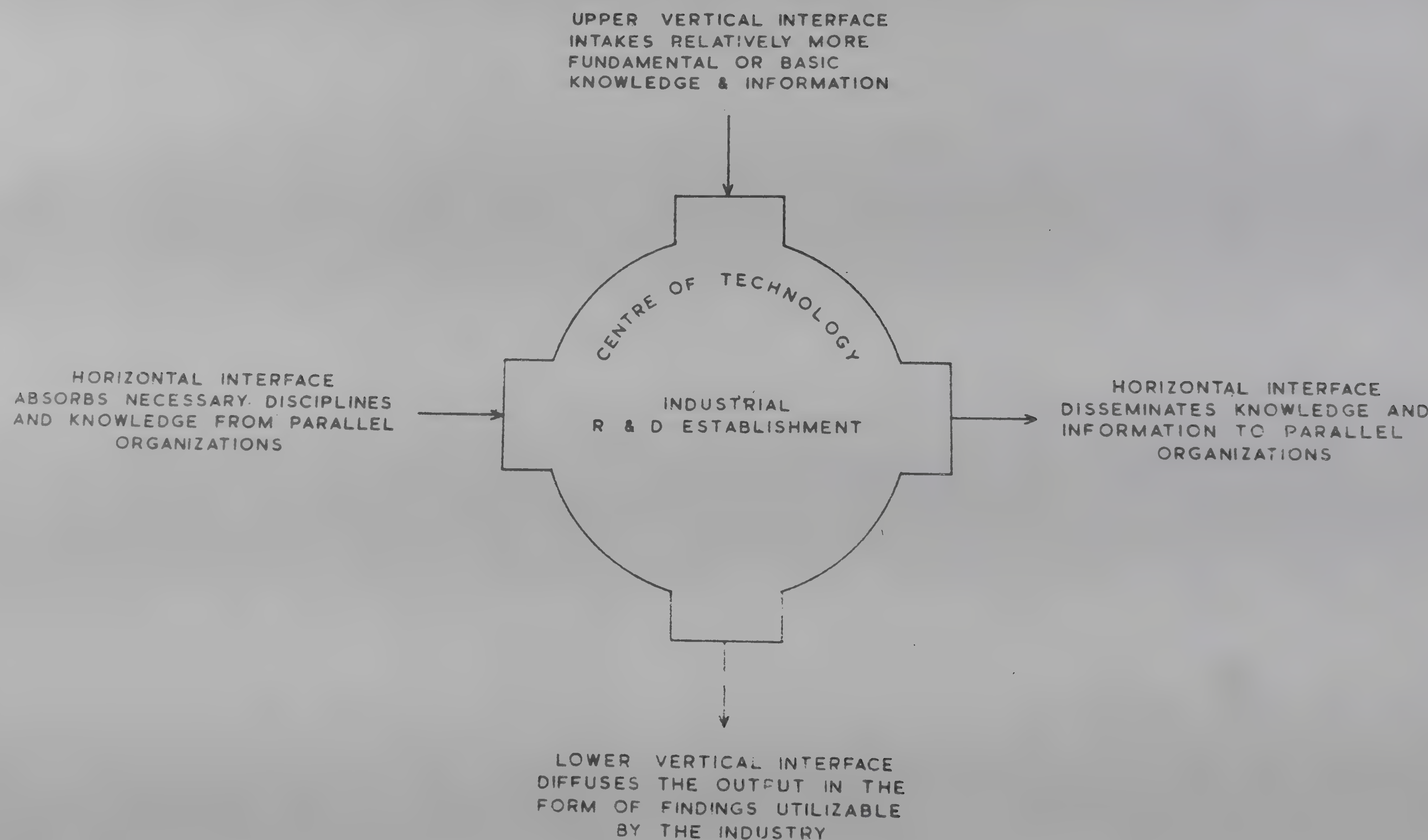

FIG. 2 : THE TECHNOLOGY TRANSFER INTERFACE SYSTEM

PAPER C-4

INFORMATION SYSTEM FOR AN INDUSTRIAL CONSULTANCY ORGANISATION

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1 *Introduction*

To better appreciate the data needs of Industrial Consultancy Services, it would be helpful to first consider, in a general way, some of the related aspects of Consultancy Profession like the role of industrial consultants in the process of industrial development, growth of consultancy capabilities, fields of operation and services rendered by major consultants and the need of having an organised Information System for Consultancy Services. The necessity for prior study of these factors arises from the fact that data collection and processing is not an end in itself but its basic motive is to provide a support function to the organisation it is supposed to serve. It would, therefore, appear logical and essential that the Information System should be tailored to suit the data needs of the consultancy operations of the concerned organisation.

2 *Role of Industrial Consultants*

a) The process of planned development in a country would involve steps such as survey of needs, survey of physical resources, long-range sectoral studies, strategy for development, fixation of priorities, financial resource studies and allocation of available financial resources to different sectors according to the priorities, preparation of Plan Documents, areas/regional studies, project identification, project formulation and development, feasibility studies, detailed plant design and project reports, construction and commissioning of plants and post plant operational studies such as plant expansion and diversification studies, plant modernisation studies and specific studies with respect to different problems of plant management like material handling, inventory control etc.

   Another vital element of the industrial development process is research and development effort related to undertaking basic and applied research for product development, this process involves conception of product on laboratory scale, complete design and development of the product, pilot plant tests and commercialisation of the product for mass production and subsequently for improvements in the product design.

b) In the Indian context physical resource studies are carried out by appropriate Government Agencies and the planning work related to sectoral studies through

preparation of Plan Documents falls under the purview of Planning Commission. The role of consultants extends from the stage of project identification stages upto post plant operational studies.

Research work in India is being undertaken by a number of research laboratories and institutions under the Council of Scientific and Industrial Research.

3 *Services Rendered by Consultancy Organisations*

Having identified the role which the consultants play in the overall industrial development process, different consultants normally select their areas of operations and develop expertise in these areas. Since the data needs for any Consultancy Organisation would depend on the scope of services rendered; it would be necessary to mention broadly the fields of operation and services provided by Consultancy Organisations.

The broad scope of services rendered by Consultancy Organisations and the fields in which they operate are:

- Techno-Economic Feasibility Studies
- Site Selection & Survey
- Regional/Sectoral Development Plans
- Market Surveys
- Project & Engineering Reports
- Tender Evaluation & Appraisal
- Detailed Plant Design and Engineering
- Construction Supervision & Management
- Plant Modernisation Studies
- Project Evaluation
- Technical Know-how
- Turn-key Services for Projects
- Material Management
- Training of Personnel
- PERT/CPM
- Procurement & Inspection of Equipment
- Plant Operation Consultancy Services

- Capacity Utilisation Studies

- Research & Development etc. etc.

To be able to render the highly specialised and diversified types of technical services the consultancy organisations would necessarily need a wide variety of technical, technological, cost, economic, industrial and statistical data. An attempt has been made in this paper to identify the broad types of information generally needed by the consultancy organisations. The discussion, however, in no way purports, to be coverage of the complete variety of data needs for the consultancy organisations in India, but is merely illustrative of the wide coverage.

4 *Growth of Consultancy Services in India*

Consultancy Services is one of the essential infrastructural institutes to accelerate and sustain the base of economic development, this is specially so in the Indian context in an environment emerging out of predominently agrarian phase into an industrial economy.

Recognizing the fact that the Industrial development does'nt merely imply the setting up of productive plants but encompasses a whole spectrum of other activities such as technical education and training, project design and engineering, research and development, construction and erection, etc., Government of India has been providing a variety of incentives to stimulate the growth of indigenous consultancy services over the last two decades.

Arising out of the recognition for the need to build up the capabilities and capacities in the highly specialised field of industrial consultancy and stimulated by the various aids and preferences accorded to the profession by the Government of India, the country has now established a fairly large and diversified range of capabilities and capacities in the field of engineering endeavour.

A number of Consultancy Organisations, both in Public and Private sectors have been established over the years. A list of some of the better known Indian Consultancy Organisations is given below:

- Bharat Heavy Electricals Consultancy Services

- Engineers India Limited

- Fact Engineering & Design Organisation

- Kirloskar Consultants Limited

- M.M. Suri & Associates

- M.N. Dastur & Co. Pvt. Ltd.

- MECON Limited

- The National Industrial Development Corpn. Ltd.

- Tata Consulting Engineers & Tata Consultancy Services
- Water & Power Development Consultancy Services (India) Limited.

5 *Need for Documentation Centre for a Consultancy Organisation*

The essentiality of the Documentation Centre emanates from the support functions it has to provide to the Consultancy operations & for its R & D Activities, Preparation and Evaluation of the Project Reports in the following areas:-

1. Provide a ready source of uptodate and verified technical, technological, industrial economic, cost and statistical data.

2. Obviate duplication of search effort by various project managers who might be seeking the same data over and over again for different projects.

3. Provide uptodate anticipatory information on new markets, trends in industries and product devélopment, etc. to facilitate the policy decisions on the development of the industrial projects.

4. Provide a systematic and continuous information service from data culled out from technical and trade publications from various countries and dissemination of such information to the concerned persons on the basis of 'Interest Profiles'.

5. Provide norms and indices to act as check-lists for evaluation of Project Reports.

Even in developed countries consultancy services must necessarily have the support of a captive in-house Documentation Centre. The need for such centres in developing countries becomes all the more imperative in view of the relative scarcity of sources even for raw data.

In addition to Collection & Processing of data from outside sources, a Data Centre is absolutely necessary for a Consultancy Organisation to make sure that permanent record of the specifications, drawings, Project Reports, etc. prepared by the organisation from time to time is available in an easily retrievable form at a Central Place for reference for future work of similar nature. The non-availability of such documents at the right time may lead to duplication of effort and thereby increase the project costs.

The main aspects of Information System dealt with here relate to the following:-

- Functional structuring
- Types of Information
- Sources of Information and its collection
- Data Acquisition and Processing
- Data Retrieval and Dissemination

- Feed-back from operating Plants
- Tender Data for Fxports
- Procedure for Data Collection & Processing
- St aff for Information System
- Working Procedures for Documentation Centre

51 Functional Structuring

The Documentation Centre in a consultancy organisation may have the following functional sections:

- Industrial Data Centre
- Display Centre
- Technical Library
- Record Room
- Reprography Section

511 Industrial Data Centre - Types of Data

i) Resource Data:

Data on physical resources like minerals, forests, agriculture, livestock, fisheries etc. and data on utilisation of available resources for different parts of the country.

ii) Equipment Data:

Data may be collected from well established suppliers of standard and non-standard production and process equipment, utilities and service facilities equipment; accessories, jigs and fixtures etc. on global basis.

The information collected would concern specifications, prices, delivery lead times, spares and accessories, jigs and fixtures etc. for machinery. plant and equipment, Approved rates of Directorate General Supplies and Disposal.

iii) Data on Building Materials, Land, Site Development and Structures:

Data on availability and costs of construction inputs like cement, steel, bricks, lime, sand, wood, paints and other such products.

Rates for construction in different parts of the country for different types of industrial structures, residential and commercial buildings, Schedules of Construction rates etc.

Names and addresses of major building contractors in the country.

Cost of land in urban areas in various regions of the country for industrial purposes.

Cost of site development works for various grades of land, sewerage and drainage, fencing etc.

Unit cost of buildings, roads, rail lines etc.

iv) Raw Materials and Intermediates:

Availability and unit costs of industrial raw materials and intermediates, import data for previous years, delivery lead times etc.

v) Utilities & Services:

- Power tariffs in different parts of the country
- Water rates for industrial and domestic use in different regions of the country.
- Cost of industrial gases, fuels etc.

vi) Rates of Depreciation:

For different types of equipment and industrial structures and other buildings

vii) Administrative Expenses:

Expenses on items such as stationary, postage, telephones, telegraphs, telex, travelling etc. for different industries.

viii) Manpwer:

- Information on sources of manpower
- Training facilities in the country and information regarding the situation of manpower at different industrial centres in the country.
- Wage rates of skilled, semi-skilled, and unskilled workers.
- Rates of different categories of supervisory, managerial and administrative staff.

ix) Information on Existing Industries:

- Like major products, plant sizes, licensed and installed capacities and utilisation of capacities, investment, manpower and annual turnover etc.

x) Rates of finished products.

xi) Rates of taxes, duties, levies etc.

xii) Rates of transportation and handling charges etc.

xiii) Broad information on process development

xiv) Industrial Regulations, industrial policy documents etc.

xv) Industrial Statistics, import & export data for industrial machinery, equipment and products.

xvi) Industrial and Construction Standards

xvii) Codes and Norms of Practice

xviii) Technical, Cost and Economic Indices

xix) Projects Reports

xx) Data Sheets and Project Profiles on different industries

xxi) Copies of previous Agreements, contracts etc.

xxii) Brochures, leaflets of Organisations dealing with industrial promotion work.

xxiii) Annual Reports and brochures of major industrial units.

Documentation Data Needed for Export of Consultancy Services

1 Of late, India has made an entry into the foreign markets specially in under-developed countries for activities such as export of Indian equipment and industrial products, for export of Consultancy Services, for setting up joint ventures and for undertaking projects on turn-key basis.

2 Consultancy Organisations would need a wide variety of readily available Documentation Data to be able to bid for such global tenders. The broad categories of data required for this purpose would comprise; National Plans, Sectoral Studies, Current Projects, availability of equipment and raw materials, availability of labour and wage rates and a lot of other data of such nature for different countries; details of data requirement for exports are furnished in Appendix-I.

512 Display Centre

Consultancy Organisations develop models of plants, collect photographs of the plants engineered by them & co-ordinate in testing of materials. The models, photographs and some of the relevant materials and selected samples of the products manufactured in such plants could be exhibited in a Display Centre.

513 Technical Library

The Technical Library should form an essential part of the Documentation Centre for a consultancy organisation. The Library would, however, keep books and publications entirely relevant to the needs of the organisation and would not be mere archive of books of general interest. Following types of publications would be relevant for such an organisation:

- Handbooks of various specialities
- Technical Encyclopedias
- Government Policy books relating to economic and industrial development
- Publications regarding customs duties, power tariffs, import and export policies etc.
- Industrial Standards
- Proceedings of seminars relevant to the activities of the organisation
- UN Publications and publications of other international organisations within the scope of activities of the organisation
- Technical books in different branches of engineering, economics and management
- Professional and technical journals and periodicals
- In-house reports and reports prepared by other consultancy organisations
- Newspapers and other relevant media of information.

514 *Record Room*

Record Room would be the repository of the project reports, tracings and drawings properly codified for easy retrieval, old journals and periodicals in properly bound form, etc.

515 *Reprography Section*

The working of any consultancy organisation and Documentation Centre would involve considerable work in making copies from stencils, making copies of documents etc. Generally the following types of equipment are provided:

- Stencil Duplication Equipment
- Diazo Printing Machine
- Microfilm Reading Equipment
- Photostat and Xeroxing equipment etc.

52 *Sources of Information and its Collection*

Information of the types needed for consultancy organisation may be obtained from a wide range of internal and external sources. Internal sources would comprise of inhouse reports and the information derived from these reports by processing. External sources for collection of such data would comprise:

- Operating Plants
- Industrial societies and associations
- Research Laboratories and Institutions
- Ministries and Government Departments
- Public Sector organisations
- Marketing organisations
- Commercial establishments
- Equipment manufacturers and suppliers
- Building contractors etc.
- Data abstracted from technical and trade journals, Newspapers etc.

A properly conceived combination of internal and external sources may be developed to achieve optimum build-up of the information required by the Organisation.

53 *Data Acquisition and Processing*

The work in the Documentation Centre of a Consultancy Organisation generally involves the following steps:-

1. Aquisition of Data
2. Organisation of Data
3. Analysis and Synthesis of Data
4. Updating of Data
5. Data Retrieval and Dissemination
6. Feed back from operating Plants.

Acquisition of Data

The acquisition of data must follow well planned procedures and it should be on continuing basis. The data on equipment specifications and prices would be obtained on a global basis through correspondence with equipment manufacturers/suppliers. The data from Government Departments, Public Sector Organisations and Commercial Undertakings may be collected by the staff of the Documentation Centre through personal liaison/visits. Considerable useful information can also be abstracted from professional Journals, Reports and other relevant published material.

Organisation of Data

The organisation of Data would be along functional lines consistent with the needs of the organisation. Every item of data has to be abstracted, classified, indexed and stored for easy retrieval. Depending upon the nature of data available in the organisation a suitable Codification System can be developed. In certain cases if data is collected from other countries, it may become essential to translate it into English, if the data is received in the native language of the country concerned. Depending upon the number of enquiries, the centre could be operated manually or it could be mechanized by use of a computer.

Analysis and Synthesis of Data

The items of raw data need to be sifted, processed, analysed and synthesised to transfer the raw data into useful, complete and meaningful information. As an example the data contained in the Project Reports can be processed into useful norms and indices to provide guidelines for preparation of Project Reports and also for evaluation of such Reports.

Updating of the Data

The prices of Equipment and Materials are subject to frequent fluctuations. As such, in cases where constant feed-in of latest prices is necessary, these would have to be revised at least once a year. Similarly, statistical data and other such data would also be updated and added to from time to time depending on the frequency of their use. Particular attention would be paid to updating to allow for any sudden changes in the prices.

Data Retrieval and Dissemination

The value of information supplied to a user lies in its timeliness. To ensure that the information reaches the correct levels at the right time, a proper and efficient system of retrieval and dissemination is essential. The Documentation Centre should maintain an "Interest Profile" of the personnel it serves. Information received in the Centre would then be scanned and disseminated in accordance with the Interest Profiles through a suitable indexing system.

Feed Back from Operating Plants

To ensure that the Documentation Centre keeps up with the latest developments; a bilateral system has to be adopted under which initially the Consulting Organisation would supply the necessary data for establishment and running of the Plant. Some of the data supplied by the consultants may have to be modified during the process of construction and commissioning of the Plant to suit the local environment and changing circumstances. These modifications/improvements should be fed back to the consultants so that such modifications can be taken into account for subsequent studies of similar nature. Otherwise also the Data Centre should keep a constant liaison with industry & keep track of latest innovations.

54 *Procedure for Data Collection and Processing*

Equipment Data:

The main data in the Documentation Centre would be on Equipment and Materials. Enquiries would be sent to major and well reputed suppliers for any particular equipment for supply of catalogues and quotations. Such requests are generally responded to in the case of standard equipment. Non-standard equipment is tailor-made and information from the suppliers can be obtained only when broad/detailed specifications are supplied. On receipt of such data, the catalogues and quotations are codified and stored for subsequent retrieval. The quotations could be further processed to prepare price cards - one price card for each item of equipment giving broad information such as specifications of equipment, name and supplier of the equipment, price of the equipment and accessories, weight of the equipment, floor dimentions, delivery period etc.

Trade Directories

Trade Directories of other countries may be obtained through High Commissions/ Embassies of different countries. This can be done by personal liaison or correspondence.

Industrial Standards

The Industrial Standards for various countries can be obtained through the Standards Institutions of various countries. These Standards are useful for selection and inspection of equipment.

Resource Data

Such data could be normally collected from concerned Ministries or culled out from different publications.

Data on Construction Rates

Such data could be compiled from existing plants and from the Schedule of Rates for different regions.

Raw Materials and Intermediates

This data can be collected through correspondence with suppliers and also it can be supplemented by abstracting such data from journals etc.

Industrial Statistics

The statistical and factual industrial data is mostly taken from the publications of Central Statistical Organisations, Directorate General Technical Development, Planning Commission and other such organisations.

55 *Staff for Information System*

Keeping in view the variety of work, personnel with different specialities would be needed to operate the system efficiently. Broadly speaking the Data Centre should

have qualified and experienced Engineers in different branches of Engineering, Scientists, Economists, Statisticians, Librarian, Translators and support staff such as Record Keepers, staff for operating reprography equipment, Stenographers, Typists, Clerks and Peons.

56 *Working Procedures for Documentation Centre*

The facilities available at the Data Centre are normally available to the staff of the Documentation Centre. Data such as Price Cards, Quotations, Catalogues, Trade Directories, Codes, Standards, Formats should be classified as Reference Material and should not be allowed normally to be taken out of the Data Centre. Other material available in the Data Centre may be issued either in original or as reproductions for specified periods.

Those in need of information should address their requests to the Data Centre and compile the information needed with the help of the staff of the Data Centre. In case of non-availability of any information in the Data Centre, the same should be obtained and kept in the Data Centre under intimation to the concerned staff.

All enquiries for Data Collection should be issued by the Data Centre to obviate duplication of collection of such data amongst various Project Managers in the same organisation and to ensure that the data collected is available to all concerned within the organisation.

An Industrial Information System is an essential overhead expense for a Consultancy Organisation. If the system is properly conceived, organised and operated, it would more than offset such expenditure and also contribute towards timely completion of jobs and save wasteful effort and expenditure which may otherwise be incurred by way of collecting and processing same data time and again for similar jobs.

APPENDIX - I

TYPES OF DATA NEEDED FOR EXPORT OF CONSULTANCY SERVICES

1. National Development Plans

2. Long range sectoral studies

3. Techno-economic Survey Reports/Regional Studies/Area Survey Reports etc. by Indian Agencies/International Agencies.

4. Trade & Commercial Directories.

5. Import/Export Statistics for major Equipment and materials for past five years.

6. Countries with which main trade is carried on.

7. Data on availability and cost of major materials of construction and industrial inputs.

8. Broad information on the state of infrastructure such as road and rail linkages, major seaports and ocean freights, air routes and air fares, technical education/training facilities, research institutes, laboratories etc.

9. Currency of the country and equivalence in relation to other currencies.

10. Position of the Country's Balance of Trade with respect to India and other countries.

11. List of major local Consultancy Organisations with their fields of specialisation and the extent of expertise available. Fields, if any, where expertise is being exported.

12. List of foreign Consultancy Organisations who are in operation in different projects and those who have been operating before.

13. List of local civil construction firms and their capabilities/capacities.

14. Current Projects, Information such as scope of work investment, Consultants, Collaborators, Equipment Suppliers. The Progress of Project at suitable intervals.

15. Rates of Taxation and Import Duties on Equipment and materials.

16. Availability of Technical manpower, skilled/semi-skilled/unskilled labour and wage rates.

17. Industrial Policy of the country including attitude towards foreign investment, Joint ventures, Local Participation, Incentives, Restrictions etc.

18. Previous tender data for major projects, such as nature of Projects, parties who bidded and the successful bidder - fees.

19. Copies of previous Agreements/Contracts, where possible.

20. Copies of Publications giving general information about the country such as Year Books - Leaflets/pamphlets, Brochures issued by organisations engaged in the process of industrial promotion/development etc. Maps of the country, copies of studies made by UN and other International Agencies.

21. Names and address of Indian High Commission, Commercial Secretary etc. and names and addresses of other Indian Commercial organisations in that country such as Engineering Export Promotion Council, State Trading Corporation etc.

22. General Living Conditions.

23. Political Climate and Stability.

24. Technological Preferences of Importing Countries.

25. Policies of Government of India in respect of exports costing of products, services, materials, facilities, drawbacks, cash assistance and constraints within which exports have to be undertaken.

26. Policies of foreign Governments relevant to their imports.

27. Status of Indians already there and their role for such projects.

28. Types of Services, equipment and hardware which is exportable from India at a given point of time.

29. Names and addresses of parties who can act as Agencies for Indian parties to give timely intimation about new tenders, supply tender documents and who could also assist in supplying the identified data.

30. Organisational structure of Economic Ministries, procedures for award of contracts etc. Important factors that count in such matters.

31. Major natural resources of the country and the extent to which they are being exploited.

32. Major existing industries and their scales of operation, management etc.

33. Organisational set up of major projects in the pipeline.

34. Quality Standards.

35. Information on criteria, Indicators and Guidelines used for appraisal of projects and award of contracts.

36. Any racial/Religious preferences on award of contracts.

37. Likely rates of inflation

38. Rate of Industrial Growth

39. Balance of payments position

40. Goods to Goods credit and soft loans

41. Performance of Consultants who have already worked in countries under purview

42. Copies of Reports produced by Indian delegations visiting such countries and also the relevant Reports produced by foreign delegations to India where copies of such Reports available.

PAPER C-5

INDUSTRIAL DATA SYSTEM – A REVIEW OF ITS SCOPES AND GAPS

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0 *Introduction*

A pre-requisite for appraising the current economic situation, ascertaining short-term economic prospects and making a rational choice from amongst the specified policy instruments is the timely availability of reliable economic data. There are several key economic indicators which provide help in doing this function, one of which is the industrial data. In the context of economic development, the role of the secondary sector in the national economy is assuming great significance as will be evident from the fact that its share to the net domestic product is about 25%.

The object of this paper is to present a comprehensive review of the available sources of industrial data, focus on the short-comings of the industrial data system, and analyse the various measures suggested from time to time by economists to improve the system.

The first section presents a general overview of the kind of industrial data and the organisations involved in their collection, processing and dissemination. The second section describes in detail each kind of data. This is followed by a review of the shortcomings of the more important data in the third section. The fourth and final section analyses the observations made from time to time by various committees and economists for making reliable and timely industrial data available for micro and macro-level economic planning.

1 *Industrial Data System*

1.1 *Categories of Data*

Industrial data may be broadly grouped as under:

(i) data on capacity, production and stocks and the related production index numbers and capacity utilisation index numbers;

(ii) data pertaining to inputs, capital, employment and output;

(iii) data on industrial establishments.

The first category of data are related to "scheduled industries" as defined in the Industries (Development and Regulation) Act 1951 and several other key industries.

These data are essential for the planning of the balanced development of the key industries. Sections 2.2, 2.3, and 2.4 describe this category.

The second category of data are related to, what is known as the organised sector (i.e., industrial units registered under Sections 2(m)(i) and 2(m)(ii) of the Factories Act, 1948) and, therefore includes industries covered by the first category as well as small-scale and ancillary units. Limited data are also available pertaining to the unorganised sector, i.e., the unregistered factories including the household industries. The major use of this category of data is to provide estimates of value-added by manufactures for purposes of national income computation. These data are also used for undertaking input-output analysis necessary for material resources planning. Sections 2.5 and 2.6 review this thpe of data.

The third category of data collected during the decinnial census, related to the census houses used as workshops and factories, i.e., industrial establishments, These data are extremely useful for regional/local-level planning. Section 2.7 deals with the data pertaining to industrial establishments.

Data on foreign industrial collaboration have been excluded from the scope of the review.

1.2 Organisations in the System

Two types of organisations are involved in the collection, processing and dissemination of industrial data:

(i) regulatory agencies which collect and maintain data for exercising regulatory power; and

(ii) agencies set up specifically for collecting, processing, maintaining and disseminating data. Collectively they constitute the industrial data system.

Among the first category are:

(i) several ministries (and departments), commonly referred to as economic ministries responsible for the development and regulation of industries;

(ii) regulatory agencies pertaining to several key industries, e.g., Textile Commissioner, Iron & Steel Controller;

(iii) Directorate-General of Technical Development, technical consultant to Government of India and the major regulatory agency pertaining to "scheduled industries";

(iv) Development Commissioner for Small Scale Industries in the Ministry of Industrial Development; and

(v) State Departments/Directorates of Industries.

The second category comprises:

(i) Industrial Statistical Wing of the Central Statistical Organisation and the National Sample Survey Organisation, both under the Department of Statistics in the Ministry of Planning;

(ii) Department of Statistics of the Reserve Bank of India;

(iii) Office of the Registrar General, responsible for conducting decennial census; and

(iv) State Bureaus/Directorates of Economics & Statistics.

The two succeeding sections give (i) a list of the economic ministries along with the names of the industries under their control (Section 1.2.1); and (ii) describe the role and functions of the Directorate General of Technical Development (Section 1.2.2)

1.2.1 *Economic Ministries*

The following ministries are responsible for the development and regulation of industries mentioned against each[1]:

(1) Department of Steel (Ministry of Steel and Mines)	Iron and Steel Industry
(2) Department of Mines (Ministry of Steel Mines)	Non-ferrous Metals and Alloys, Mining Industry
(3) Department of Petroleum (Ministry of Petroleum & Chemicals)	Mineral Oils (Crude Oil) Motor and Aviation Spirit, Lubricating,Oil etc., Fuel Gases.
(4) Department of Chemicals (Ministry of Petroleum & Chemicals)	Heavy Chemicals, Fertilisers, Fine Chemicals, Plastic and Plastic Products, Dyestuffs, Drugs and Pharmaceuticals, etc.
(5) Department of Heavy Industry (Ministry of Industry and Civil Supplies)	Iron and Steel Structure, Machinery and Equipment.
(6) Department of Industrial Development (Ministry of Industry and Civil Supplies)	A wide range of Chemicals, Equipment and Instruments.
(7) Department of Electronics	Electronic Equipment and Components.
(8) Department of Food (Ministry of Agriculture)	Sugar and Vanaspati
(9) Ministry of Commerce	Textile and Jute Products.

1.2.2 *Directorate-General of Technical Development*

The Directorate General of Technical Development (formerly known as the Development Wing, in the earstwhile Ministry of Commerce and Industry), an attached office under the control of the Department of Industrial Development functions as a technical consultant to the Government of India. It is the major source of information about the industrial sector - regulatory, technical and statistical[2]. It is responsible for assisting in the planning and development of industries to secure a

well balanced and properly coordinated pattern of industrial growth of the country, in conformity with the Industrial Policy Resolution 1956. In fact, its charge of formulation and execution of development plans covers all the industries, other than iron and steel, textiles, jute, sugar, vanaspati, and petroleum. About 3,500-4,000 production units involving 75,000 items of products, raw materials, components and spares,etc. are borne on its registers.

Some of its major functions are:

(i) collection and compilation of industrial data relating to installed capacity, actual production, employment position, stock prices, etc., as well as appraising their trends to the ministries concerned;

(ii) examination, from technical angle, of applications received under the Industries (Development and Regulation) Acts, 1951 for establishing new industrial units or for effecting substantial expansion of existing production units;

(iii) advising on collaboration terms in respect of industries seeking foreign collaboration; and

(iv) scrutinising applications for import of capital goods, raw materials.

1.2.2.1 *Integrated Information System*[3]

In view of the ever-growing need for precise and timely information for planning and industrial development, the organisation had planned to introduce a computer-based integrated information system which envisages, among others, the establishement of:

(i) a machinery for the collection and compilation of industrial data;

(ii) codification of industries, products, and reporting units;

(iii) data bank comprising products and industry files; and

(iv) collection of norms adopted by the directorate for processing import, industrial licensing and other applications.

In developing this system, DGTD was first guided by Booz Allen and Hamilton International Inc., a management consultancy organisation. The organisation submitted its report in February 1966. After three years, the work of conducting a system study and subsequent designing and implementing this information system was entrusted with the Indian Institute of Management, Calcutta, in February 1969. The first two phases of the assignment involving the conceptual framework of the system and its design have been completed. The third phase comprising (a) programming, debugging, and final testing of programmes, and (b) data collection and creation of data base is in progress. In this phase, the priorities are:

(i) compilation of monthly production statistics; and

(ii) analysis of import licences for raw materials, industrial lincences, capital goods licences and foreign collaboration data.

To facilate collection and processing of data on production, the "monthly produc-on return" has been redesigned in 1975. In order to monitor the half-yearly progress ade in the establishment of industrial undertaking the "G" form as prescribed under ule 19 of the Registration and Licensing of Industrial Undertakings Rule 1952, has lso been suitably modified.

However, the Integrated Information System is yet to start functioning in spite f the recommendations of the Estimates Committee of the Parliament for expeditious troduction of the System[4]. The basic information about the industrial sector, roduction data, are available with considerable time-lag.

2.2.2 *Publications*

The Public Relations and the Publications Directorate of the Directorate-eneral of Technical Development brings out several serial publications concerning e industries falling within its scope:

Handbook of Indigeneous Manufacturers of Engineering Stores
(Updated frequently)

Handbook of Indigeneous Manufacturers of Chemical and Miscellaneous Stores
(Updated frequently)

Handbook of Industrial Data (Updated frequently)

Annual Report (presents a comprehensive review of the industrial science with statistical data)

Two recent ad hoc publications are worth mentioning:

Handbook of Foreign Collaborations (1974)

Directory of Industrial Units - State-wise and Industry-wise (1974).

The Directorate-General announced in 1972 its intention to introduce a uarterly Journal of Industrial Development which had not yet materialised.

Review of the Available Data

While describing the various statistical data in this section, it will be found at the data are presented in accordance with some classification scheme. This ection, therefore, begins with a description of the industrial classification schemes. his is followed by the review of three categories of data described in Section 1.

1 *National Industrial Classification, 970 (NIC - 1970)*

An Industrial classification scheme is essentially the classification of economic ctivities which produce goods and services.

A wide variety of classification schemes are now in use in India. In the field f labour statistics, three different types of classification schemes are used, one of hich is compiled by the Labour Bureau. The Directorate General of Employment

and Training has been using the Standard Industrial Classification evolved by it in 1958. This scheme was also used for the 1961 population census. ASI uses its own scheme for the census sector while for the sample sector the Labour Bureau's scheme is used. The Central Statistical Organisation has evolved in 1962 the National Standard Industrial and Occupational Classification which is used for the classification of industrial production data. This scheme at the third digit level has also been in use in the recent rounds of National Sample Survey.

In order to achieve comparability of statistical data available from various sources of different dimensions of the economy, a standardised national classification system is an imperative necessity. As a matter of fact, to facilitate international economic comparison, it is necessary to link up the national scheme with the international scheme. An attempt to achieve this was initiated in 1964 and 16 organisations which are required to use classification schemes participated in the deliberations. The result has been the designing of the National Industrial Classification, 1970 (NIC ^{o}- 1970)[5]. The scheme has absorbed the major features of the revised International Standard Industrial Classification, 1968. In future, all kinds of economic data will be classified by the NIC-1970.

The scheme provides for classification at (i) one-digit level (representing Division); (ii) two-digit level (representing major groups); (iii) three-digit level (representing groups); and (iv) four-digit level (representing sub-groups).

2.2 *Statistics of Production*

The data on production are collected by various agencies, each one being responsible for a specific industry or a group of industries. The Directorate-General of Technical Development (DGTD) is responsible, among others, for the collection and compilation of data relating to installed capacity and production in respect of a wide range of manufacturing industries; DGTD is thus the most comprehensive source of information about this topic. Section 2.2.1 discusses the comprehensive sources, while Section 2.2.2 deals with sources relating specific industry or group of industries.

2.2.1 *Comprehensive Source*

The most comprehensive source of production data is the Monthly Statistics of the Production of Selected Industries of India (MSPSI) compiled by the ISW. DGTD provides data in respect of about 80% of the 442 items normally included in the publication produced by manufacturing units having fixed assets of more than Rs. 7.5 lakhs. Data for the remaining items are furnished by the following 14 regulatory agencies:

Industry	Source
Coal including Lignite	: Coal Controller, Calcutta.
Minerals (except Petroleum but including Gold)	: Indian Bureau of Mines, Nagpur.
Sugar and Vegetable Oil Products (Vanaspati)	: Chief Director, Directorate of Sugar and Vanaspati, Delhi.

Coffee	: Indian Coffee Board, Bangalore.
Tea	: Tea Board, Calcutta.
Salt	: Salt Commissioner, Jaipur.
Cotton and Wool, Art Silk Fabrics, and Textile Machinery	: Textile Commissioner, Bombay.
Jute	: Regional Office (Jute Development),Calcutta.
Electricity	: Central Water and Power Commission (Power Wing), Delhi.
Iron and Steel	: Iron and Steel Controller, Calcutta.
Petroleum Products	: Ministry of Petroleum and Chemicals
Railway Wagons	: Railway Board, Delhi.
Railway Locomotives	: Chittaranjan Locomotive Works, Chittaranjan, and Tata Engineering and Locomotive Co. Ltd., Jamshedpur.
Other Industries	: Directorate-General of Technical Development, Delhi.

The returns on the basis of which the production and stocks statistics are estimated are voluntarily submitted to these agencies (including) DGTD, except in the case of coal, sugar, salt, cotton textiles, woolen textiles, iron and steel, all minerals except petroleum and gold where the collecting agencies have statutory powers to call for returns. Production data in respect of small units are excluded.

The publication covers the following:[6]

1. All-India data regarding (a) reporting units, (b) installed capacity, and (c) production and stocks.

2. State-wise production of about 79 selected industries

3. Index of Industrial Production (Base 1960=100)

The industries are classified according to the National Standard Industrial and Occupational Classification. For each item, monthly averages of latest five years and actual data for the latest 13 months are given.

The MSPSI is, however, very irregular. Only three issues were published, covering the data for the reference period, October 1969-June 1971:

Vol 22, No 1 - April 1971 (presents _inter alia_ monthly data for the period October 1969- October 1970) released late 1972.

Vol 22, No 2 - May 1971 (presents _inter alia_ monthly data for the period May 1970 - May 1971) released early 1973

Vol 22, No 3 - June 1971 (presents inter alia monthly data for the period June 1970 - June 1971) released late 1973

An issue for March 1972 containing, inter alia, monthly data for the period March 1971 - March 1972 was promised but was not published.

According to the ISW, the production data are received in its office "from the concerned agencies with a time-lag of about 12 weeks. The compilation of production data and computation of index take about two weeks. The statistics is thus available with a time-lag of about sixteen weeks. But on account of printing delays, the published data become available only after a considerable interval.[7] With a view to making the data available to the users as soon as these are ready, a mimeographed publication, Monthly Bulletin Showing Production of Selected Industries of India and the Index of Industrial Production was introduced, containing the data for November 1968. The publication was made available free to selected institutions. The Bulletin provided provisional data for the current three months, in respect of about 312 items with an average time-lag of about 26 weeks. (For example, the data for February were released in late September 1972). However this time-lag continued to increase. The data for the period April-September 1973 could be published in a combined issue released in late April 1974. With effect from the reference month October 1973, the title of the publication (continues to be a mimeographed document) has been changed to Monthly Production of Selected Industries of India and has been made a priced publication.

To sum up the situation:

(i) Beyond June 1971, Production data are available for about 312 items instead of 442 items which used to be covered by the Monthly Statistics. Either some items have been dropped or aggregated data for a group of items are provided.

(ii) Access to detailed production and index data for the period June 1971 - September 1973, has become very difficult, since the copies of the ad hoc Monthly Bulletin are not readily available.

(iii) Current data as well as monthly averages for the years 1971-73 are available in respect of selected items only from Monthly Abstract of Statistics. The time-lag is about seven months. For example, data for September 1974 are available by the end of April 1975 (published in the March 1975 issue).

(iv) Beyond 1971, no data pertaining to stock position are available.

Other sources in which data relating to selected items are published are:

(i) Statistical Abstracts, India (Annual data for selected industries).

(ii) Report on Currency and Finance (Data in respect of 40 items/group of items are presented under four "use-based" groups: (a) Basic Industries, (b) Capital Goods Industries, (c) Intermediate Goods Industries, (d) Consumer Goods Industries)

(iii) Reserve Bank of India Bulletin includes one table of production data for 33 selected items.

(iv) Annual Report of the Directorate-General of Technical Development [The report for 1972-73 presented production data (along with number of units, installed capacity, value of production) of about 750 items for 1971 and 1972. The report is thus a very valuable source for disaggregated production data. Also included in the report are capacity licensed as at the end of 1972, and capacity utilisation in major industries during 1972].

The National Data Institute (Kanchenjunga, Ist Floor, Barakhamba Road, elhi 110001) proposes to set up a computerised National Product Bank consisting f four data files, viz., product, capacity, production and technology. The system ould be able to provide information according to product or industry, State, district, own or village and obtain instant computer print-outs of licensed and installed apacities, production, etc., as and when required.[8] There is, however, no ndication that this venture has made any headway.

.2.2 *Sources for Specific Industries*

Generally the regulatory agencies pertaining to specific industries are required collect, process, and disseminate data for the products coming within their purview. ome examples are given below:

(i) The Office of the Cement Controller publishes a comprehensive annual tatistical document entitled Cement Production and Despatches.

(ii) Indian Bureau of Mines publishes a comprehensive statistical review entitled ndian Minerals Yearbook. For disseminating current information it has a bi-monthly ublication, Bulletin of Mineral Statistics and Information.

(iii) The Office of the Textile Commissioner presents a general review of the extile industry and comprehensive statistical data on different facets of the industry hrough its monthly journal Indian Textile Bulletin. Annual statistical data relating o machinery and equipment in the cotton mills are published in a special issue of this ournal.

Similar data are also published by Chambers of Commerce and industrial asso- iations. For example, the Fertiliser Association of India brings out two serial publi- ations, viz., Fertiliser Statistics and Production and Consumption of Fertilisers - nnual Review.

Another source of statistical data is the reports of the various committees and ommissions. The Report of the Committee on Drugs and Pharmaceutical Industry is case in point. The report of the Tariff Commission on the fair selling prices of drugs nd pharmaceuticals, similarly contains useful production data.

. 3 *Index Numbers of Industrial Production (INIP)*

The index numbers of industrial production indicates changes over time in the olume of production in the organised industrial sector and measures at regular inter- als the general movements in the volume of industrial output. The following series of ndex numbers preceded the current series[9] with Base 1960=100:

(i) Interim Index of Industrial Production (Old Series) (Base 1937=100). The series covered 15 industries in three sectors - manufacturing, mining, and electricity. The series was discontinued in 1949;

(ii) Interim Index of Industrial Production (New Series) (Base 1946=100). Introduced in January 1949, this series covered 36 items of 20 industries. It continued up to April 1956;

(iii) Revised Index of Industrial Production (Base 1951 = 100). The publication of this series started from the October 1955 issue of the MPSPI and covered 88 items production; and

(iv) Index of Industrial Production (Base 1956 = 100). In accordance with the recommendations of a Working Group which looked into the adequacy of the index numbers, another revised series covering 201 items of production was first published in the July 1962 issue of the Monthly Statistics.

The current series of INIP[10] with Base 1960 = 100 are based on regular monthly series for 317 items and annual series of 125 items. Though the published index is based on regular monthly series for 317, the weighting diagram is drawn up on the basis of the total 442 items with a view to using the same set of weights for the regular monthly index and the annual index covering the additional items as well. While compiling the monthly index for a sub-group, if any item for which regular monthly series are not available occurs in that sub-group, the weight of that sub-group is adjusted by dropping the weight of such item. However, no such adjustment is made while computing the group index from such sub-groups. This method is followed at all the stages.

The general (i. e., overall) INIP is the weighted arithmetic mean of the indices of the constituent items. The weights are proportional to the value-added by manufacture in the base year (i. e., 1960) to different item at the three digit level of industrial classification according to the ASI-60 covering both the census and sample sectors.

The crude general index of every month is adjusted for seasonality by appropriate seasonal factors derived from the crude general index on the basis of twelve-month moving average method.

INIP was first included in the September-October 1967 issue of MSPSI. The publication used to provide group and sub-group indexes for the current 13 months and the crude as well as seasonally adjusted monthly general index since 1961. As mentioned in Section 2.2.1, MSPSI has been superseded by Monthly Production of Selected Industries in India. It gives only the current three months' data (including the crude and adjusted general index) in each issue.

The data are also reporduced in the following publications:

(i) Monthly Abstracts of Statistics: - gives general, group and sub-group indexes for the current 14 months and annual data for the latest four years.

(ii) Reserve Bank of India Bulletin: - gives general index (unadjusted and adjusted) and sub-group indexes arranged under four headings - basic industries, capital goods industries, intermediate goods industries, and consumer goods industries (durable and non-durable). Data are given for

the current six months and current five years. Similar data are also published by the Bank in the Report of Currency and Finance.

(iii) For retrospective data, Statistical Abstracts, India is the useful source.

2.3.1 *Reserve Bank of India Derived Series*[11]

As has been mentioned in the preceding section, the revised series of INIP is classified and published according to Standard Industrial Classification. Since for analytical purposes this classification system was found inadequate, the Reserve Bank of India reclassifies and re-arranges the items in the INIP into four major groups on the basis of use-base classification, viz.,

(i) Basic Industries;
(ii) Capital Goods Industries;
(iii) Intermediate Goods Industries; and
(iv) Consumer Goods Indsutries.

The index numbers for these four groups derived from INIP by the Bank are published in the Reserve Bank of India Bulletin. From July 1970, two more derived series have been introduced. In one, items are rearranged under three major input based industries viz., (i) Agro-based industries; (ii) Metal-based Industries; and (iii) Chemical-based Industries. In the other, the relevant items are rearranged under two sector-based groups, viz. (a) Transport Equipment and Allied Industries; and (b) Electricity and Allied Industries.

2.4 *Production Capacity and Capacity Utilisation Data*

The Statistical Intelligence Division, in the Department of Statistics of the Reserve Bank of India (RBI), has attempted at measuring the production capacity and capacity utilisation[12], using a variant form of the "trend-through peaks method" developed at the Wharton School[13], Instead of using the terms, measures of "Production Capacity" and "Capacity Utilisation", the RBI had used "Index of Potential Production or Potential Indices, and Potential-Utilisation Ratios, or briefly, the Utilisation Ratios or Rates."

Potential for any given industry has been defined as the peak (maximum) monthly level "of production attained for that industry at the point of time or prior to it at which potential is measured." This definition assumes that potential of an industry once built up, does not normally decline in subsequent period. Thus, if the peak monthly production for a given year is lower than that of the previous year, the earlier peak will be taken as the potential for subsequent years till a new higher peak is attained. Potential-Utilisation ratio for an industry/industry-group has been defined as the percentage ratio of the average monthly production index to the potential production of the industry/industry-group, during the period of one year.

The Index of Pontential Production (IPP) (Base 1960 = 100) is constructed using the current series of INIP which has also the base 1960=100. The potential-utilisation ratio (PUR) is then derived from the IPP and INIP. Data relating to IPP and PUR have so far been computed for the years 1960 to 1971 for 72 manufacturing industries which account for 82 percent of the weights in INIP.[14]

As is done in presenting INIP data in the Reserve Bank of India Bulletin, the industries are arranged according to use-based and input-based classifications.

Data in respect of installed capacity of different factories were also collected through National Sample Survey for the period 1961-1968. However, this data have not been tabulated so far.[15]

2.5 *Annual Survey of Industries*[16]

The enactment of the Industrial Statistical Act 1942, facilitated the systematic collection, compilation and dissemination of industrial data. In accordance with the provisions of the Act and the Census of Manufacturing Industrial Rules (1945) framed thereunder, the Census of Manufacturing Industries (CMI) was initiated in 1946. CMI covered 29 out of the 63 industry groups.

In order to increase the scope of the survey, Sample Survey of Manufacturing Industries (SSMI) was introduced in 1950 (the reference year being 1949) on a voluntary basis which covered all the 63 groups. Thus, there was inevitable duplication in respect of the industries covered by the two surveys.

With effect from 10th November 1956, the 1942 act was replaced by the Collection of Statistics Act, 1953 (Act No. 32 of 1953) in order to avoid duplication and to adopt a programme of integrated collection of industrial statistics. Accordingly, the Collection of Statistics (Central) Rules 1959 under the 1953 Act were framed providing for a comprehensive ASI as from the reference year 1959. The ASI thus replaced both the CMI and the SSMI.

The CMI data are available for the period: (i) 1944-1945 (on voluntary basis); and (ii) 1946-56 (on statutory basis); and (iii) 1957-58 (on voluntary basis). The SSMI data are available for the period 1949-58.

ASI is a continuing survey carried out from year to year. Till April 1973, twelve rounds (i.e., ASI-59 to ASI-70) were completed. Normally a new round of survey is undertaken on completion of about 90% work of the preceding round. The objectives of the survey are:

(i) estimation of the contribution of the manufacturing industries as a whole and of each unit to the national income;

(ii) systematic study of the structure of the (a) manufacturing industries as a whole, (b) each type of industry, and (c) each industrial unit;

(iii) causal analysis of the various factors influencing industries; and

(iv) provision of comprehensive factual and systematic basis for policy formulation.

2.5.1 *Coverage*

The unit of survey under ASI being the factory, the industrial units registered under section 2(m) (i) and 2(m)(ii) of the Factories Act 1948, constitute the frame. These sections refer respectively to factories using power and employing 10 or more workers and factories not using power but employing 20 or more workers on any day

in the preceding 12 months. ASI has also extended the survey to public utilities like water supply, sanitary services, electrical undertakings, etc. Factories located in Jammu and Kashmir are covered on a voluntary basis since the Act does not apply to this State.

ASI is conducted in two sections - census sector and sample sector. Factories in which the manufacturing process is carried out with the aid of power and which employ on the average 50 or more persons as well as those in which no power is used but employ 100 or more persons. Electrical undertakings are completely enumerated irrespective of size of manpower. Remaining registered factories constitute the sample universe. The field of work for both the sectors are conducted by the Field Operations Division of the NSSO.

At the instance of the erstwhile Ministry of Industrial Development and Company Affairs, commencing from ASI-66, specified groups of industries in the small sector are being completely surveyed every year. Thus, four specified groups have been covered since ASI-66, viz., ASI-66 & 67. Metal and Metal-based industries; ASI-68 - Chemicals; ASI-69- Textile group; and ASI-70 - remaining industries. All the factories falling under these industry groups were covered irrespective of their being included in census and sample lists. Excluding those covered in census and sample sectors, the remaining factories are grouped as Residual Small Scale Industries (RSSI). The factories owned by cooperative societies were covered for the first time in ASI-67 on a complete enumeration basis.

ASI returns meet the needs of several user organisations, e.g., Central Statistical Organisation, Labour Bureau, Department of Industrial Development, National Buildings Organisation, besides the State Governments. Currently, the returns consists of four parts covering the following elements of information.

Part - I - power equipment, capital, installed capacity, employment, emoluments, inputs and outputs;

Part - II - man-day worked, absenteeism, labour turnover, man-hours worked, earnings, and social security benefits.

Part - III - stocks and sales of products and imported materials consumed; and

Part - IV - residential tenements constructed/purchased and their cost.

Part I was introduced since the inception of the ASI which, however, underwent several changes in respect of the detailed item from time to time. Part II was introduced at the instance of the Labour Bureau since ASI-61[17]. As regards the sample sector, the return now consists of only Part I.

Since the commencement of ASI till the completion of ASI-65, the reference period for collection of data relating to most of the industries was the "calendar year" (i.e., from January to December). For operational convenience, from ASI-66, the reference period was changed to the "accounting year" of the factory which ends between 1st April of the reference year and 31st March of the succeeding year. For example, a ASI-69 covers factories which closed their accounts on any day during 1st April 1969 - 31st March 1970.

Since ASI-67, combined summary of results of both the sectors are being published by the ISW in Annual Survey of Industries - Summary Results for Factory Sector. The publication is based on the summary block (Block 2) provided in the ASI returns which contains information about 17 principal characteristics of the factory. The first part, among others, reviews the survey while the second part, presents data relating to 17 principal characteristic in the following forms;

(i) aggregated data (all-India and all-industries combined)
(ii) industry-wise data (all-India)
(iii) State-wise data (all-industries combined)

For each characteristics, data on sample and census sectors are given separately. It also gives break-up of the data of census factories according to large units and small-scale units (i. e., those having a gross investment in plant and machinery of Rs. 10 lakhs or less). Data on percentage change in output and value-added to industries, and the relative contribution of census are sample sectors in selected items for each State are presented in two tables.

ISW also publishes for limited circulation, Annual Survey of Industries - Capital Employment and output - Estimates for Factory Sector by Capital size.

ASI reports for the census and sample sectors are also published separately. These documents have been described in the next two sections.

2.5.2 Census Sector

Although data for the census sector is collected by the Fields Operations Divisions of the NSSO, they are processed and published by the ISW. Census sector data are published in 10 volumes. The first volume gives, among others, two tables viz, (i) State-wise summary of (all-Industries combined), and (ii) industry-wise summary (all-India data). The following elements of information are covered in the tables:

i) number of factories;
ii) capital employed;
iii) manpower;
iv) wages, salaries, benefits, etc;
v) inputs and outputs;
vi) man-hours worked;
vii) value-added by manufacturer; and
viii) percentage of wages, salary, etc. to value-added.

Other tables present industry-wise data on the following topics:

i) power equipment;
ii) value of additions to fixed capital and other transactions; and
iii) quantity of electricity purchased, produced and sold.

The Appendix gives (i) the text of Collection of Statistics Act and the corresponding rules, (ii) classification system for the industries, (iii) definitions, concepts, and procedures pertaining to ASI, and (iv) forms of returns. The remaining nine volumes present State-wise data for each industry. The following tables (each table containing appropriate break-up data) are given for each industry:

i) number of factories;
ii) productive capital employed;
iii) manpower, man-hours and emoluments;
iv) fuel, electricity, etc, consumed;
v) materials consumed;
vi) products and by-products manufactured;
vii) value-added by manufacturer; and
viii) summary by accounting period of factories.

The industries covered in ASI are classified in accordance with a scheme designed for the purpose. The scheme covers 26 major industry groups (two-digit classification) divided into 75 groups (three-digit classification). Some industries are further sub-divided into sub-groups (four- and five digit classification). Approximately, 269 groups/sub-groups are annually reported in ASI. ASI has now adopted NIC-70 mentioned in Section 4.1.

At present the survey period extends over about 22 months and it takes about another 12 months for collecting the returns from the field agency. The latest publication relates to the survey for 1966. Till the end of 1975 there were no further ASI, reports.

The over-all response from the factories in the census sector is satisfactory as will be evident from the following data in respect of ASI-69'.

State-wise Response

Response %	Number of States/Union Territories.
100	3
97-99.2	12
93-96.2	5
89-80.0	3
50.0	1
96.7 (All-India)	24

Industry-wise Response

Response %	Industry Groups
100	22
95.4-99.7	23
90.9-94.5	11
81.8-89.9	4
96.7 (All-Industries)	60

Provisional summary results are published separately under the title, Annual Survey of Industries-Census Sector (Provisional Results) - General Review. The publication is in three parts. Part I is a summary review. Part II gives the industrial classification at 3-digit level. Part III comprises three tables:

i) Industry-wise summary (all-India);
ii) State-wise summary (all-industries combined); and
iii) State-wise data for each industry.

In tables 1 and 3 data are presented up to 3-digit level of industrial classification. Like the Annual Survey of Industries - Summary Results for Factory Sectors, mentioned in section 2. 5. 1, this general review is based upon the summary block (Block 2), provided in the ASI returns. The data similarly cover 17 principal characteristics of the factory.

2.5.3 *Sample Sector*

The sampling design for the sample sector is a stratified uni-stage one where the State-cum-industry classification forms the strata. The sample size for different strata are decided upon with a view to providing usable estimates for (i) each industry at all-India level, (ii) each State for all industries taken together, and (iii) two major industries in each State (i. e., first two industries when arranged in order of their industrial employment in the concerned State). The sample in any stratum is drawn in the form of two inter-penetrating sub-samples each of size half the allocation to that stratum. The two sub-samples are selected in circular systematic manner and without replacement in such a way that there are no common units between them. A stratum is completely enumerated when (i) its allocation is more than the total number of factories in it (ii) the number of factories in it is small, and (iii) the difference between the total number of factories in it and its allocation is small. Several States/Union Territories are completely enumerated. Since ASI-68, it was decided to cover the entire sample universe in three years and, therefore, one-third of the sample universe was covered in each of the three surveys, viz, ASI-68, ASI-69, and ASI-70. The industries having less than 100 units in the sample universe on all-India basis were also decided to be completely enumerated. Thus the number of factories allotted (Sample size) rose from 6,187 in ASI-67, to 15,827 in ASI-68. The corresponding figure for ASI-70 is 21,427. In ASI-71, the sampling design has been reduced to 25% instead of one-third. The sample sector on the whole account for less than 20% of the value-added and employment in the registered factories sector.[18]

The field work is conducted by the Field Operations Division of the NSSO. The data are processed and published by the NSSO in National Sample Survey Series in two stages:

(i) Tables with Notes on the Annual Survey of Industries - Sample Sector - Summary Results

(ii) Tables with Notes on the Annual Survey of Industries - Sample Sector - Detailed Results

The following tables are presented in the publication.

Table I - Estimates of selected items (all-india) for all-industries as combined by sub-sample;

Table II- Estimates of Selected items (State-wise) for all-industries by sub-sample; and

Table III - Estimates of selected items for each industry (all-India) by sub-sample; and

Table IV - Estimates (for sampled strata) and aggregates (for complete enumeration strata) of selected items for each State by industry and by sub-sample (for sampled strata).

The term "Items" mentioned above refers to various dimensions of industrial tivities. In the publication containing summary results only about 16 items out of the tal 89 items of activities are considered. The detailed results cover 89 items in ble I & III, and 45 items in the Tables II & IV.

5.4 *Time Series Data Based on CMI and ASI*

The terms of reference of the National Commission on Labour provided for study d report, inter-alia, on "levels of workers" earnings, provisions relating to wages, e need for fixation of wages including the provision of incentives of workers". ccordingly, the Secretariat of the Commission examined the data available in the CMI 946-1958) and the ASI (1959-1964). The data available from these two publications ere retabulated and published and presented under the title Statistics of Selected lanufacturing Industries. The publication is in three parts:

Part I: All-India Summary Tables and Industries for which Continuous Time Series are Available for the Period 1946 - 1964.

Part II: .. .. for the period 1946-1958.

Part III: .. .. for the period 1960-1964.

As is evident from the title, only those industries for which continuous time eries were available were included in these publications. Part I covers both CMI as ell as ASI data, while Parts II and III are limited to CMI and ASI data, respectively. arts I and II cover 15 industries each, while Part III covers 21 industries. Due to ifferences in coverage and the method of data collection as between CMI and the ASI, esults are not strictly comparable. Data relating to ASI are limited only to the census ector and are given for all the years, i.e., 1960-1964. In the case of CMI, data or the period 1946-1958 are given at intervals of three years.

For each industry, three tables for each State have been presented:

(i) Main Characteristics (i.e., number of registered factories, percentage covered, productive capital, employees, manhours worked, wages, salaries and benefits, gross inputs and output, value-added by manufacturer);

(ii) Selected Indicators relating to the characteristics; and

(iii) Economic Ratios (based on the characteristics).

The Appendix of Part 3 gives percentage of wages to gross output.

2.6 *Unorganised Industrial Sector*

Although the industrial activity of a large number of units not covered by the Factories Act, 1948 is very significant, not much statistical information is available for this unorganised sector. There are four significant sources of data about the sector

(i) ad hoc surveys made by the State Governments;

(ii) National Sample Survey;

(i) ad hoc surveys made by the State Governments;
(ii) National Sample Survey;
(iii) A Comprehensive Survey Sponsored by the Union Government; and
(iv) Boards/Commissions in the cottage and village industries sector.

2.6.1 *Ad hoc Surveys*

Several ad hoc surveys of widely divergent scope were conducted with specific objective by different States at different points of time. The available data are, therefore, neither comparable, nor can all-India estimates be worked out on their basis. A perusal of the Sample Surveys of Current Interests (Vol. 1, 1949/50) published by the Central Statistical Organisation will give an indication of the nature of the surveys.[19] However, the information given in the publication is not comprehensive since several all-India Boards like Khadi and Village Industries Commission, Coir Board, also regularly undertake sample surveys and ad hoc studies with a limited purpose. They are not covered by this publication.

2.6.2 *National Sample Survey*

Information regarding small-scale manufacturers was collected in several rounds but an organised effort was first made during the 7th round carried out from October 1953 to March 1954. The approach of the survey "was through households which were engaged in small scale manufacture and handicrafts enterprise at least in the subsidiary caharacteristics for one day during the last 365 days prior to the date of listing".[20] The survey covered all activities in a small-scale sector described under the major group codes 2, 3 and 4 of the International Standard Industrial Classification. Government agencies, joint stock companies and other non-household enterprises engaged in small-scale industries were outside the scope of the survey. Also excluded were the manufacturing industries covering all establishments (including household) registered under Factories Act 1948. The survey thus does not overlap ASI, but complements the ASI data. The reports are published as a part of the series of National Sample Survey.[21] In the Report No. 94 relating to the Fourteenth Round, for each industry group, estimates have been provided for the following items:

(i) number of manufacturing households;
(ii) number of workers engaged per working day;

(iii) working days in a month;
(iv) hired labour charges;
(v) output; and
(vi) fuel, lubricants, raw materials, and other expenses.

Two separate sets of data are presented for rural and urban areas.

The collection of data on household enterprises continued through eighth, ninth d tenth rounds. The schedule was again canvassed during the fourteenth and twenty-rd rounds. Several modifications were, however, introduced in the subsequent unds. In the twentythird round, renewed efforts were made to cover the non-household anufacturers and a separate schedule was canvassed for collection of data. New ocks of inquiry have since been introduced on the availability of raw materials, State sistance, working capital, and outstanding loans. A stratified two-stage sampling sign was adopted in this round but efforts were made to increase the size of samples d improve the representative character of the samples. Results of the twentythird und were not available till the end of 1975. The draft report No. 229 reporting the sults of non-household sector is with the Government for clearance and publication. ne household sector data are still under process.

6.3 *Comprehensive Survey*

The Ministry of Industrial Development launched in 1968-69 a Centrally-spon-ored scheme to be operated by the State Departments of Industries/State Statistical ureaus for the survey of the unorganised industrial establishments. The Central atistical Organisation survey is responsible for technical coordination to ensure uni-rmity in the survey. The scheme, divided into four phases, envisaged a complete numeration of all the units. If, however, for an industrial sub-group (fourth digit vel) the number of units at the district level was more than 100, sampling might be esorted to. The four phases are as under:

(i) a quick census for preparing a comprehensive list of industrial units to be covered by the survey leading to the compilation of State-wise directory;

(ii) detailed survey through a schedule of enquiry finalised by the Central Statistical Organisation which covers details of operation, power used, capital, outstanding loans, employment and emoluments, inputs and outputs;

(iii) tabulation of the State and district tables by the State authorities; and

(iv) aggregation of State tables to generate all-India tables by the Central Statistical Organisation.

The scheme is expected to cover about 1.6 lakhs of small industrial units and ollect comprehensive statistical data from them. However, the progress of the scheme as been woefully disappointing.

.6.4 *Boards/Commissions*

There are several Boards and Commissions in the Cottage and rural industries ector, like Handloom Board, Sericulture Board, Khadi and Village Industries Commis-ion (KVIC). These organisations often bring out ad hoc survey reports, publish annual

reports, and occasionally disseminate statistical data in their house journals. The annual report of the KVIC is accompanied by a statistical supplement containing data about 22 industries.

2.7 *Industrial Establishments - Decennial Census Data*

2.7.1 *1961 Census*

At the 1961 Census, for the first time, comprehensive data were collected on census houses, and among others, two tables were prepared on full count. One table (Table E-1) relates the uses to which census houses are put, while the other (Table E-III) classifies census houses used as workshops and factories (i.e., as industrial establishments) (i) by nature of industry (using Standard Industrial Classification); (ii) kind of power used (electricity, liquid fuel, coal, wood or bagasse; and other/no power); and (iii) size of employment (classified into seven categories depending on the number of persons employed). Parts IV (A) and IV (B) of the census publications (All-India as well as State/Union Territory Series) contain the report of Housing and Establishments and Housing and Establishment Tables, respectively.

In the All-India series of the census documents (i.e., Vol. I), the Table E-III presents data pertaining to India, States, Union Territories, and big cities with population of one million and above. Separate data for urban and rural areas are given in respect of the first three categories. The All-India series gives three subsidiary tables relating to each State, Union Territory/other area, and big cities:

(i) E-III.1 - Proportion of establishments according to divisions, major groups, and selected minor groups (i.e., one, two and three digit-level classification) to 1,000 establishments;

(ii) E-III.2 - Distribution of 1,000 establishments in each kind of fuel by size of employment; and

(iii) E-III.3 - Distribution of 1,000 establishments in each division, major groups, and minor groups by kind of fuel or power used.

In the State/Union Territory series, E-III tables present data for (i) the State/Union Territory as a whole, and (ii) each district, (separately for rural and urban areas) as well as for each city and town having a population of 50,000 and over. Although the data have been compiled down to the Anchal level, they have not been included in Volume IV(B) of the State/Union Territory series. Statistics of village industries extracted from the census house data have been included in the District Census Handbooks and the Village Directories.

2.7.2 *1971 Census*

At the 1971 census, a separate establishment schedule was canvassed to collect a variety of information on manufacturing, trade as well as other establishments run in the census houses. This schedule provides a more or less complete frame of all establishments in the country. The E-series Tables compiled on full count basis are entirely devoted to establishment data which are being published as the Part III (Establishments Report and Tables) of both the All-India and State/Union Territory Volumes. Of the four tables in the E-Series, the following are concerned with manufacturing, processing, or servicing (Industrial) establishments:

(i) Table E-I, a new one introduced in 1971 census, gives the distribution of all establishments by three abroad categories, viz., (a) industrial establishments, (b) trade or business establishments, and (c) other establishments in each of the government or quasi-government, private or and cooperative sectors of the economy. The industrial establishments are further classified as registered factories, unregistered workshops, and household industries.

(ii) Table E-II A gives information about industrial establishments other than household industries under two categories - registered factories and unregistered workshops, classified by size of employment in each Division/ Major Group of NIC-1970.

(iii) Table E-II B presents the distribution of industrial establishments other than household industries classified by industry (using NIC 1970), fuel/ power (or manual) used as well as by size of employment.

(iv) Table E-II C presents data similar to those included in the table E-II B in respect of household industries.

In all the tables, data are presented separately for rural and urban areas.

3 *Shortcomings and Gaps*

In this section, four major dimensions of industrial data shall be considered:

(i) Index Numbers of Industrial Production;
(ii) Statistics of Production;
(iii) Data on Productive Capacity and Capacity Utilisation; and
(iv) Annual Survey of Industries.

The review in this section is largely based on the critical analysis of the data system made by economists in the two seminars on Data Base of Indian Economy[22] organised by the Indian Econometric Society and the Report of the Data Improvement Committee chaired by Dr. S. S. Minhas.[23]

The major criticisms about the industrial data system may be summarised as under:

(i) availability of data after a considerable time-lag rendering them useless for timely assessment of economic situation;

(ii) methodological shortcomings;

(iii) limitations imposed by non-response and the related problem of adjustment;

(iv) non-comparability of data over time in view of change in the coverage;

(v) classification gap arising out of inability to present the data in a form most useful to the users; and

(vi) absence of certain types of data, i.e., data gaps.

In this section, general observations on time-lag and gaps will be followed by specific comments relating to the shortcomings pertaining to the four major aspects listed in the beginning.

3.1 *Time-lag*

Curiously enough, the time-lag in the availability of almost all the key economic indicators has increased over time, and there is no indication that the situation will improve in the near future. While in the past, the production index used to be available with a time-lag of 3 months, to-day even the crude data are available with a time-lag of 6-8 months for the use of officials.[24] As has been mentioned in Section 2.2.1 these data are available to non-official users disseminated through official publications after about 14 months. The time-lag in respect of the detailed report of the Annual Survey of Industry has reached an all-time high of about 10 years.

All these facts lead to some basic questions - whether there is any need for these data for taking decisions? What is the quality of decision based on outdated data?

3.2 *Data Gaps*

Several major data gaps in the industrial data system have been revealed in the course of the various analysis made by the economists:

(i) non-availability of detailed and reliable data from the small scale manufacturing sector involving more than a crore of units/households;[25]

(ii) inadequate data about distributive trade;[26]

(iii) absence of a system of preparing forecasts of industrial output;[27]

(iv) absence of a coordinated effort for compiling input-output tables for industries;[28]

(v) inadequate and inaccurate data about productive capacity and capacity utilisation[29];

3.3 *Index Numbers of Industrial Production*

(a) Apart from the time-lag, the Minhas Committee has pointed out three limitations[30] of the production index numbers:

(i) adoption of erroneous correction system for non-responses. For example, wherever the responding units account for 80 percent or more corrective measures are adopted, but no such action is taken if the response is below 80%. The Committee was unable to "discern any rationale behind the procedure adopted to adjust data for non-response;

(ii) non-comparatability of the index over time on account of changes in the DGTD list, (a) either because of units going out of existence, or because of new units coming into operation; and (b) changes in the criterion for registration/licensing with DGTD. The apparent decline in the rate of industrial growth in 1970 was attributed to the transferance of a number of

units to the small sector. No corresponding adjustments were made for the earlier years in order to maintain comparability[31].

(iii) Any item meant for inclusion only in the annual index gets reported in the monthly index as well. This introduces the element of non-comparability to the extent that the variations in the output of the new items differ from output variations in the case of items in the sub-group already included in the monthly index. It does vitiate the usefulness of the data for studying trends in particular groups or sub-groups of industries.

(b) According to Rao, the index of industrial production being Laspeyre type of index number, it generally underestimates the actual change in the industrial scene. Adoption of base-year weights introduces an element of under-estimation, while the adoption of current year weights would introduce some over-estimation.[32] However, this argument has been disputed.[33]

(c) The question of changing the base year, has thus been raised from time to time since the present index underestimates the real growth of industrial output because it does not allow for the changing share of different industries in total output. Srinivasan and Vaidyanathan[34], however, had argued that this by itself should not be a reason for changing the base year since growth rate would remain the same. The Data Base Seminar also noted this misunderstanding and misconception and recommended that a new weight base becomes really necessary only when (i) there is a structural change in the sense of changes in the value added per unit of output of items and prices relatives of inputs and outputs; and (ii) a number of new items claiming substantial share of the total value added is being produced during the period between current base period and the proposed base period.[35]

3.4 *Statistics of Production*

Some of the observations made in the preceding section also holds good for the statistics of production since this set of data provides the basis for the compilation of index numbers.

Other shortcomings are:

i) The major shortcoming of this data base arises out of the inability to present data in a form most useful to the potential users. Non-availability of disaggregated production data for several commodities is a case in point.

ii) Inappropriate use of units of measurement to quantify the commodity is another drawback of the production data. For example, in some cases capacity and production are expressed in terms of value which does not convey any meaning. In some cases, installed capacity and production are expressed in value terms while the stock position is indicated by numbers. Venkataraman has referred to this problem faced by him in the course of a study on the underutilisation of industrial capacity[36].

(iii) the problems created by the present form of disseminating production data have already been referred to.

(iv) the capacity stock position and state-wise production data have since been abruptly omitted from the Monthly Production of Selected Industries in India.

3.5 *Productive Capacity and Capacity Utilisation*

At present there are three sources of information on this topic:

i) ASI

ii) Reserve Bank of India data

iii) MSPSI (It is presumed that this data in the near future will be again included in the concerned publication)

ASI data are comparable to those available in US, Canada, and Norway. While such data in these countries put to use in testing important economic hypothesis regarding economics of large scale production and the form of the production function, ASI data were collected under non-disclosure provisions of the relevant act and, therefore, are not made available even for research purposes.[37]

The RBI data have been critically reviewed by Krishna, focussing on the methodological shortcomings.[38] He, however, has observed that inspite of the limitations pointed out by him and this series of data is of some value in assessing the inter-temporal trends in capacity and capacity utilisation. As regards the MSPSI data, Krishna,[39] on the basis of the studies carried out in Gokhale Institute, US Agency for International Development, NCAER, pointed out several drawbacks of the data. For example:

i) official figures of capacity for the vanaspati and domestic Refrigerator industries were underestimates;

ii) figures of capacity, in some cases, far exceeds that of production;

iii) to the extent the official basis for assessment of capacity did not take into account technical feasibility considerations, official statistics underestimated the capacity.

3.6 *ASI*

The major shortcoming of the ASI data is again the considerable time lag with which the reports are made available to the users. The time lag is attributable to the delay in collection, processing and printing of the publications. The sheer dimension of the universe of the survey presents almost an unsurmountable difficulty in making any meaningful coverage and reducing the time-lag. During the second seminar on Data Base of Indian Economy, the ASI data, particularly those related to Sample Sector, was discussed in great details and dissatisfaction at the inadequate coverage of the small sector as well as the unorganised sector was expressed. It was also questioned whether it is possible to meaningfully cover the unregistered sector in which the industrial activity is carried out by households without having any identifiable establishments, and which is carried out by people who are incapable of providing any sophisticated information about the concerned activity.[40]

Some other defects of ASI are:

i) sampling fractions of the ASI-Sample Sector are fixed on more or less non-statistical or administrative grounds for different industry-groups. Thus the coverage ranges from 20% to 100%.[41]

ii) the classification of factories as small, medium or large scale on the money value of fixed capital is not satisfactory.[42]

iii) distributive trade needs to be brought within the purview of the ASI.[43]

Suggestions for Improvement

We shall not attempt here to enumerate all the suggestions and recommendations made from time to time for improving the quality of industrial data. The two reports of the seminar on Data Base of Indian Economy and the report of the Data Improvement Committee provide relevant information. We shall, therefore, make several general observations and refer to some major recommendations which involve major policy decisions.

At the outset it is necessary to highlight the point that economic data, no matter how good and timely they are, can be meaningfully utilised, provided the user has an appropriately defined analytical framework. Without this pre-requisite, it is extremely difficult to specify the data requirements with any precision. This clarity can be achieved, provided more and more data are used, wherever relevant for taking policy decisions. The Data Improvement Committee was struck by the fact that very few agencies and individuals are hardly aware of the utility of data and the extent of their availability.[44]

Although it is necessary to strive continuously for further refining the available data and to attempt to bridge data gaps, making the economic data available within reasonable time to all concerned is of utmost importance. B.S. Minhas attributed the lack of timeliness to the absence of analytic traidition on the part of the policy makers and equally conspicuous absence of a traidition of empirical work in the economic profession. Most of the ailments of the data system, in fact, may be attributed to these two factors. He had suggested two methods for encouraging the producers of one data to do their work in time (i) instituting formal analytical frameworks for undertaking major policy decisions and (ii) increasing use of empirical data for economic research.[45]

Considering the importance of ASI as well as the unmanagable volume of the data involve several suggestions have been made:

i) Instead of canvassing the detailed schedule every year, it would suffice if it is canvassed less frequently. A less detailed schedule can be used annually.[46]

ii) improving field scrutiny of data to reduce the desk scrutiny.

iii) desk scrutiny should be reduced by resorting to sampling

iv) improving the sampling frame to give wider coverage to the small scale sector.

Of late we have been talking about computerised data bank as if it is a substitute for the analytical work involved in the collection and processing of data. So far no clear idea has also emerged about the scope and utility of such expensive ventures. The widely publicised proposed data bank at the DGTD Office still exists on paper. We do not do whatever is feasible. For example, telex facilities for quick transmission of data, use of computers for processing row data, and using of xerox[47] and off-set printing methods will reduce considerably the time lag. The cost involved is also marginal.

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19. For a State-wise list of surveys for the period 1949/50 - 1970/71 based on this document, see GUPTA S K. Surveys for the Unorganised Sector (In Dandekar V M, Venkataramaiah P, Ed. Data Base of Indian Economy Vol. 2 Calcutta, Statistical Publishing Society, 1975 pp. 293-5).

20. Tables with Notes on Small Scale Manufacture - Rural and Urban - Household Enterprises Smaller than Registered Factories (National Sample Survey, No. 94). p. 2.

21. So far three reports are available - No. 42 (Seventh and eighth round, No. 43 (ninth and tenth round), and No. 94 (Fourteenth Round).

22. The reports of the two seminars have been published: (i) Rao C R, Ed. Data Base of Indian Economy - Review and Reappraisal. Vol I. Calcutta, Statistical Publishing Society, 1973. 253p.; (ii) Dandekar V M, Venkataramaiah P, Eds. Data Base of Indian Economy - Role of Sample Surveys. Vol 2. Calcutta, Statistical Publishing Society, 1975. 422p. For brevity these documents will be cited as Data Base, Vol I and Data Base, Vol 2, respectively.

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41. Data Base Vol. 1 p. 28

42. Ibid. p. 26

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PAPER C-6

INDUSTRIAL INFORMATION IN INDIA

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This century, specially the post World War II period, has seen a revolution in the interrelation between applied research and industry. As a direct result of this revolution, the time-lag between innovation and application could be cut down drastically. In the last century, fifty years elapsed between Faraday's demonstration that an electric current could be generated by moving a magnet near a piece of wire and Edison's building of the first central power station. After World War II, the transistor passed from invention to industrial production in a mere three years and more recently research on lasers was hardly complete when the industry started using it to design new long distance transmission systems.

Now, what has really caused the time-lag between innovation and application to disappear? Many socio-economic as well as political factors responsible for this miracle are outside the scope of the present paper. However, apart from these factors, a very big role in it was played by proper and quick two-way communication between scientists and industrialists. This communication forms the essence of industrial information and it is the Information Scientist, the generalist in a crowd of specialists, the so-called 'backroom boy of science', who has made the world recognize the vital role of this type of information in industrial development. Industrial information is essential not only for the quick implementation of new innovations, but is also of prime importance at every stage of industrial development of a nation - from planning and policy formulation at the macro-level to the establishment of an industry and running it at the micro-level.

However, in spite of its importance, till recently very little concerted and systematic effort had been made in India to establish an effective machinery for collection and dissemination of industrial information. As a result, the industrial information collected in formulating the five year plans has been haphazard, chaotic and, we dare say, often subjective. The fault lies not only with the government and industrial research organizations, but also to a large extent with the industry itself whose generation of and demand for information have been minimal.

Lack of Demand

The inherent character of industry in India is such that it is content with conventional processes and techniques and seeks out only the minimum of ad hoc information needed for its day-to-day running or short-term planning. The main reasons for such complacence are: (i) monopolistic nature of the industry, resulting in lack of competi-

tion and a sellers' market, (ii) easy availability of foreign know-how under collaborative arrangement, (iii) lack of risk capital and the will to experiment with new processes and techniques, (iv) cheap labour which precludes the need for labour saving devices, (v) little check on quality of products, and (vi) lack of a firm industrial policy.

The structure of the industry in India is notoriously heterogeneous. On one hand, we have multi-million rupee steel plants employing the most modern technology and equipment, while on the other we have cottage scale units manufacturing cheap, washing soap in make-shift sheds, employing the most primitive methods. In between these two extremes, there exist a number of levels of sophistication which makes the Indian industry highly stratified. The information needs of the various strata of industry differ widely and so, necessarily, should be the means of satisfying these needs.

A serious drawback of this stratification is that the information generated by the different strata has a tendency of lateral and not vertical diffusion. For example, the information generated by the R&D sections of big industrial enterprises does not benefit the cottage or even the small scale industries. Moreover, a close secrecy is often maintained over new innovations and improvements of old methods and techniques for very obvious reasons, thus limiting even the lateral mobility of information.

From the preceding discussion it would appear that there should be a demand for industrial information at least from the middle and lower strata of the industry, which invariably do not have any R & D activity and are, therefore, unable to generate their own information. That this is actually not so is due to two main reasons: (i) the middle and lower level industries are largely not aware that industrial information is available (if they are aware, they often do not know how to obtain it and from where) and (ii) the existing facilities for storage and dissemination of industrial information in the country are not geared to meet the demand made upon it.

The second point needs a little elaboration. Our research is not tuned to the difficulties faced by the lower strata of industry. Therefore, the industrial information that we have is often at a more sophisticated level than what is needed by industries at those strata. Moreover, the language in which we speak is very often unintelligible to industrialists and technical personnel operating at these levels. A case in point is the soap-maker from Akola who came to the Publications & Information Directorate with some operational problem he was facing. In spite of our best efforts we could not satisfy him completely, because the primitive method he employed generated the particular problem, the solution to which could not be found in the learned books and journals. What this particular case highlights is that our industrial research and, consequently, our information retrieval and storage systems have no link with the industry at the lower strata. But what about the more sophisticated sector of the industry? Ironically, the higher strata of industry which we can help with the information available with us rarely ask for it.

Stimulation of demand

What is described above is then the situation which we have to reckon with before we can even think of establishing a comprehensive machinery for collection and dissemination of industrial information which may be helpful to all levels of industry in the country. The case is, however, not hopeless. Neither is the situation unique for our country. Most of the countries which can today boast of a high level of industrialization had to pass through such a phase and are even today trying to bridge whatever communication gap there exists between research and industry.

Joel Lundberg of the Swedish Textile Research Institute has found that even very large firms in Europe produce only 2 per cent of the knowledge necessary for the manufacture of their new products. May be a much larger percentage of the knowledge is generated in situ for improvement of already existing methods. These firms may bring out technically sound and economically feasible products with the marginal knowledge generated by themselves. But surely, in the larger interest of the industry as a whole and of the nation, it is imperative that more knowledge resting with sources outside the firms be utilized suitably. If this is the case with advanced industrial nations, it should be more true for the developing countries where the industry spends much less on R & D.

A need for industrial information, therefore, exists, although it may be in a dormant form and not easily recognisable from outside. The industry must be made to realise the need, so that a demand for industrial information should grow. The demand has to be stimulated at the beginning before it actually gets into its strides. And what could be a better way to stimulate the demand for a particular commodity - if there is a real use for it - than by building up an easily accessible supply of it?

Types of information

Before proceeding any further, we should consider what types of information should be actually needed by the Indian industry. As stated earlier, the diverse nature of the industry in India will necessitate the generation of a number of types of information. However, they can be grouped under three broad heads. These are:

(i) technical information on manufacturing processes;

(ii) statistical data relating to capacity, production and availability of raw materials for individual industries; and

(iii) economic and social information, which should pertain to both national and international trade of industrial products, areas of import substitution and technology transfer and other information which should generally help in planning the industrial sector.

Role of government

This brings us to an important question. Who will be responsible for the creation and running of a national machinery for industrial information? The industry is automatically ruled out due to reasons discussed earlier, although participation of the industry will always be welcome and in fact should be encouraged. The choice then lies between the government and a government-aided autonomous or semi-autonomous body. Here, taking flexibility and non-bureaucratic functioning as the prerequisites for such a machinery, the scale is tilted towards the latter. If the machinery for industrial information were to be operated by the government, it might have the appearance of a controlling body, and the information scientists working for it might not be seen in their true perspective but as mere inspectors.

On the other hand, an autonomous body like CSIR, which is actually carrying out industrial research, lays emphasis in its charter on "the collection and dissemination of scientific and technical information in regard not only to research but to industrial matters generally", and already possesses a skeleton system for industrial

information, seems more suitable to evolve an integrated system for industrial information and run it. However, as the collection and dissemination of industrial information are going to be vital in the planning of a national policy for industrial development, the government has to play a crucial role in it. Moreover, the government through the public and joint sector, controls a sizable part of the industry. During the years to come, its participation in the industry is likely to increase significantly. Therefore, in its own interest, it should be the prime mover in the field of industrial information and the government controlled industries should set example to the industry at large in generating, absorbing and spreading such information.

Existing sources

Let us now take stock of the existing sources of information in the country. The CSIR has two central organizations, namely, Publications & Information Directorate (PID) and Indian National Scientific Documentation Centre (INSDOC). The PID is engaged in collection and dissemination of scientific and technical information through various publications like scientific periodicals, an encyclopaedia of raw materials and industrial products entitled Wealth of India, monographs, proceedings of scientific and technical conferences, etc.

The INSDOC has established an elaborate documentation service, and it acts as a national repository for reports of the scientific work done in India. In addition, the CSIR in its various research laboratories and institutes operates cells for the collection and dissemination of industrial information pertaining to the fields on which the laboratories are doing research. To develop contacts with the industry, and to promote the utilization of research and knowledge available with CSIR laboratories, polytechnology clinics are being set up in a number of states.

Small Enterprises National Documentation Centre at Hyderabad collects and stores data and documents useful in the technological and managerial advancement of small industries.

Some of the other sources of industrial information are the Directorate General of Technical Development (DGTD), Ministry of Industrial Development and other ministries relating to particular industries, Planning Commission, Export Promotion Councils for various industries, Indian Institute of Investment, Trade Development Authority, Indian Institute of Foreign Trade, National Council of Applied Economic Research, Central Statistical Organization, Department of Commercial Intelligence and Statistics, Indian Standards Institution, National Research Development Corporation, and Development Commissioner for Small Scale Industries (DCSSI) which operates the Small Scale Service Institutes (SSSI) in the states. At the state level the Directorates of Industries are potential sources.

All the organizations named above are either government departments or semi- or fully-autonomous bodies. In addition, some major public and private sector enterprises disseminate selective information mostly through their house journals. Other sources of information are the various trade associations related to different industries.

None of the information sources listed above covers the entire gamut of industrial information. Some of them may deal with facts and figures, while some may have technical know-how. However, it seems that we do not have to start from a scratch in building up an integrated machinery for the collection and dissemination of industrial

nformation. The task before us is to develop a comprehensive system which would have nterlinkages with the existing centres. The system should be viable to the present ndustrial scene and ensure that the right information is made available to the right arty and at the right time.

lational Industrial Information System

This brings us to the final stage, that is the structure and functioning of a ational industrial information system. The National Science and Technology Plan repared by the National Committee on Science and Technology has already considered he establishment of a National Information System for Science and Technology (NISSAT) luring the Fifth Plan (1974-79). The system for industrial information, therefore, will ave to be a component of NISSAT.

It is the avowed principle of the Government of India to develop the industrially ackward areas of the country. This is a laudatory gesture and is perfectly justified n the context of the socio-economic development of the country. Any such development, o have a significant impact, should necessarily start at the bottom rung of the ladder. Collection and dissemination of industrial information should, therefore, be started at he grass-root level of industry, that is, to be specific, at the level from which the soap-maker from Akola operates. To achieve this we would need, besides stationary librarians, documentalists, and information scientists, what we may call industrial 'legmen'. The legmen are particularly necessary for establishing a first hand, personal contact with the industry. For only one thing is better than personal contact - more personal contact! Needless to mention that the legmen besides having a broad-based knowledge of industry, should be able to speak and write in the language of the particular region.

The roving information operators or legmen should operate from bases which should preferably be district headquarters. The idea is that, like Block Development Officers appointed by the State Governments, these legmen will form a body of 'Block Information Officers'. A central office at the district level will co-ordinate the work of this team and will supply them with necessary industrial information drawn from the SISI, national laboratories in the region and bigger centres which have to be located at the state capitals. These centres at the state capitals should work in close collaboration with state departments of industries and industrial development corporations. Needless to say, the centres at the district headquarters and those at the state capitals should have adequate facilities for documentation, information retrieval and reprography.

To co-ordinate the working of these regional centres, a national organization will have to be established. The responsibility of this national organization will be manifold and flexible according to the demand made upon it. Besides co-ordinating, guiding and recording the work done by the two tiers of regional information centres mentioned above, the national organization should be responsible for maintaining a central data bank for all industrial information, acquisition and manipulation of Indian and foreign literature, bringing out current awareness journals on various groups of allied industries by a synthesis of information available from all available sources, organizing training facilities in industrial information work, and developing co-operation with similar information centres in India and abroad. Thus, the integrated system will be a three-tier one with ample flexibility and facility to make industrial information move both laterally and vertically.

Personnel

Finally, a few words regarding the personnel required to operate the machinery for industrial information seem to be relevant. It should be realized that industrial information is a commodity which attains its true value to society only when it is appli in the production of goods and services. Hence, those who work for the information system should be, first of all, agents for and promoters of this commodity. They will have to assume a great responsibility towards the clientele, which in this case will constitute not only the industrial sector, but also all the organizations responsible for the economic and social development of the country.

Conventional information scientists, editors, librarians and documentalists are not strangers to the basic functions of informatics. They should play a very impor tant role in collaborative arrangements between research and industry and also between industry and industry, and in the collection and dissemination of selective information. However, for a far-flung industrial information network to succeed, it would also require industrial extension officers. These officers would be mainly responsible for establishing an appropriate and meaningful dialogue with the staff and management of factories and workshops. This would require that these officers be in possession of an adequate knowledge of particular industries (and those allied to them) with which they are to deal.

PAPER. C-7

STANDARDS INFORMATION SYSTEM FOR NATIONAL DEVELOPMENT

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I am happy to participate in this seminar organized by the Indian National Scientific Documentation Centre to mark the 80th anniversary of International Federation for Documentation (FID). When the invitation was extended to me to speak on standards information system, I readily agreed to do so for two reasons. Firstly, ISI has been an active member of the National Committee of FID and we certainly wish to associate ourselves with this auspicious event. During the eight decades of its existence FID has made valuable contributions towards the advancement of information science and technology and promotion and unification of information activities around the world. Through the efforts of stalwarts like F. Donker Duyvis and Dr S.R. Ranganathan, FID has been closely associated with the international work of standardization in documentation and has been collaborating actively with the ISO Technical Committee for Documentation (ISO/TC 46). Secondly, I like to share with this gathering of eminent specialists our thoughts and ideas on reorganizing and strengthening our information set-up and to have the benefit of your comments and suggestions.

It is, therefore, appropriate that while commemorating the 80th anniversay of a worldwide organization like FID, we should take a look at the information scene in our country and make an appraisal of the information handling facilities in relation to their adequacy and capability to aid the task of national development.

National Information Scene

It is indeed a happy augury that after many years of vacillation and debate at various levels plans for developing the necessary infrastructure for establishing national information system for science and technology has been taken up in right earnest. Evidently recognition is now growing that information is one of the most vital of our national resources and that it is necessary for this resource to be effectively developed, conserved, distributed and utilized. But the growth of recognition of the importance of information is far outstripping the growth of recognition of the national information problem. So the information problem has to be widely understood as the national resources exploitation and development problem that it is, and this requires a coordinated approach to the problem.

Communication Through Standardization

The essence of scientific and technical information transfer is contained in the process of communication. The development of scientific knowledge depends on the

communication of new theories and new experimental observations. The knowledge explosion is having a great impact on the organized systems for handling scientific and technical information. The volume of literature is growing so rapidly that no one scientist or engineer can be aware of more than a small portion of it. One result if it is greater specialization on the part of scientists. A concomitant of this trend has been the strain on and specialization of the traditional information services, namely, the journals, abstracting reviews and libraries. The effective functioning of these services through efficient development of scientific information and documentation systems has, therefore, become indispensable if scientists are to communicate easily with one another and knowledge is not to remain compartmentalized and undiscovered as a resource for national welfare. Standardization as an interdisciplinary subject offers to my mind a most important and effective means of improving this scientific and technical communication system.

I shall go to this aspect in detail a little later. Just now I would like to say a few words on the role of standardization in national development in order to bring out the need for standards information system as a part of the network of national information system.

Standardization and National Development

Standardization has become a predominant feature of present-day industrial civilization. In fact it is difficult to think of any organized collaboration at the international level or for that matter even at the national level without industrial standardization. The process of standardization itself in turn rests on the bedrock of co-operation and partnership between various interests, such as the producer and the consumer, the supplier and the buyer, the scientist and the technologist, the designer and the technician - all bending together to determine and establish the focal point of agreed solutions from a maze of diverging viewpoints. Standardization has, therefore, been defined as a process of formulating and applying rules for an orderly approach to a specific activity for the benefit and with the co-operation of all concerned, and in particular for the promotion of optimum overall economy taking due account of functional conditions and safety requirements.

There is an intimate, and to some extent, unique relationship between standardization and industrial growth. Standardization is at once a cause and an effect of the phenomenal expansion of industry witnessed in modern times. Ever since the ascendancy of the factory system of mass production, standardization has been an important factor in the advancement of production techniques and automation.

Whenever there is transition from production to consumption, standards come into play. This transition works not only at the ultimate point of use but also at a number of intermediary stages. The total growth of production in a country is marked by a corresponding rise in mutual interdependence of different production centres. Each has to look to the other for the supply of raw materials, machinery, tools and services. This complex relationships and interdependence render the use of standards absolutely necessary to facilitate the flow of materials through the various transition points. In general, the aim is to achieve overall economy in production while maintaining a minimum level of quality of output, to protect the user interest, and to ensure safety and protection of health and life.

In the formulation of standards, it is, therefore, necessary to adopt the method of intensive consultation among all the interests concerned. At the national level, the

extent of such consultation will vary from country to country according to its socio-political structure, but rarely are standards laid down arbitrarily by a superior authority without consultation of people concerned. Thus, although the procedure of consultation varies, the principle is more or less universal in all national standards activity.

When goods and services are exchanged between nations, standards provide a common language and criteria for judging the value of goods and services, and a mechanism for establishment of methods by which they can be put to optimum use. The benefits of standardization at international level are similar to those at the national level, namely, communication between suppliers and consumers, inter-changeability of components and equipment, and the elimination of unnecessary varieties of materials, equipment and products.

The above results are achieved through the development of agreed glossaries of terms and definitions, specifications, methods of sampling, methods of gauging and testing, and codes of practice.

Standardization and Technological Efficiency

There is another aspect to these questions. Standards play an important part in ensuring a smooth and efficient flow of production. If, for example, a scarcity of some material is brought to light in the process of industrial expansion, it may be possible to devise standards which reduce the input of this material or substitute another. We have achieved this in India, for example, conservation of nickel in the case of steel and substitution of aluminium for copper for cables and conductors. Efficiency and the avoidance of waste in industrial production are needed in developing and industrially advanced countries alike. Here, many factors are involved including research and development work, the learning process required to adapt local application of a technology developed elsewhere. Modern technology in fact is inconceivable without standards and in a large measure is expressed through standards which provide a coherent summary of information about current technical practice. Thus, standards become important means of communicating information.

Science, Technology and Standardization

The transfer of technology between countries or within a given country is an essential part of industrial development. The speed of the transfer can limit the speed with which new industries are established which has been proved without doubt that where activities of standard have taken root and spread through the management level of industry, most useful tool has been forged for the transfer of technology.

The phenomenon of interchangeable components produced to standard specifications is a cornerstone of modern technological efficiency. Science and technology have enlarged the concept of interchangeability to include optical, electrical, electronic, chemical and thermoparameters in addition to the parameter of dimension. Thus, technology opens up new areas for standardization which in turn may further promote technological efficiency. We see then that intimate relationship exists between science, technology and standardization. In all these three areas control functions are important, namely, the controlled experiment of the scientist, the instrumentation and feedback controls of technology, the quality controls and inspection needed to put standardization into practice. It is in this broad context that standardization is to be viewed.

What I have said bears ample testimony to the interdisciplinary character of standards as well as their multi-point application cris-crossing the complex scientific, industrial and commercial fabric.

Today about 8,500 Indian standards are in force covering most fields of agricultural and industry. Together they represent the distilled experience and viewpoints of some 30,000 scientists, industrialists, management specialists and consumers. We have, thus a valuable national resource assiduously built up over a period of more than two decades. In order for this resource to be properly developed and utilized, a speedy and efficient information and documentation system becomes indispensable.

Information Needs

National standards organizations have, therefore, been forced to recognize the need for providing information about their standards. With the growth of trade and international communications, users all over the world expect an extensive service including information on international standards and standards from other overseas countries. An index to the magnitude of the problem is provided by the fact that today the fund of world standards and specifications available is estimated at over 300 000. These include standards developed by 79 national standards bodies, international organization like ISO and IEC, UN agencies like FAO, WHO and ILO and various other learned societies and associations.

As the need for information continues to grow, national standards bodies have set up special departments for the dissemination of information on standardization. Information about standards may be sought to answer several types of queries concerned with various operations, namely, purchase, design, manufacturing, test methods, export trade, etc. These operations are peculiar to a manufacturing establishment. But a research and development organization, a municipal body, a commercial establishment an export house or association or a purchasing department of the Government would in addition like to keep track of the progress in standardization in the development of new and revised standards and also in regard to the progress and policies in standardization at the national as well as international levels.

Dissemination Systems

To the documentalist, standards pose unique problems involving detailed indexing, cross-referencing and translation. Being prone to continuous review and amendment, they pose the problem of frequent updating.

The queries which must be answered in standards documentation fall into two distinct categories: (a) questions which can be answered swiftly from a catalogue or a retrieval system, and (b) questions which require comparison and evaluation work on the content of a standard document. In general, a broad spectrum information is required to be provided in regard to the following:

a) New and revised standards;

b) Amendments;

c) Draft standards circulated for comments;

d) New subjects;

e) Implementation;

f) Research and development work;

g) New developments relating to standardization;

h) Developments pertaining to the International and overseas standards;

j) Current standards literature.

Hitherto, standards bodies have been employing all the available conventional means for dissemination of information including technical handouts and notes, periodical publications, selected subject lists, handbooks, reports and specialized library services including up-to-date card indexes, supply of bibliographies, circulation of abstracts, and technical enquiry and translation services.

Computerized Information Systems

Conventional methods, though quite effective upto a point, have their own limitations when one has to deal with a large volume of literature and information is required to be retrieved with speed and urgency. Because of the growing information need of the users and specially the demand of evaluative information from standards, computerized retrieval of information is gaining momentum. A number of national standards bodies especially those of USA, Germany, UK and France are in the process of mechanizing their information collection, storage and dissemination processes in the interest of providing a more effective and expeditious service. The Soviet Union is already engaged in developing an automated information retrieval system for standards for the last 3-4 years.

The Standing Committee for the Study of Scientific and Technical Information (INFCO) of ISO has been making effort since 1970 for the development of an automated process of storing, retrieval and distribution of information on standardization. A decision was taken in 1972 to develop a unified information system within the framework of ISO (ISONET). The objectives of the ISO information network are:

a) to provide mutual application of achievements by ISO member countries in industrial and scientific studies implemented in the new standards;

b) to privide coordinated requirements of the countries in preparation of joint arrangements on production cooperation and mutual supplies, industrial construction and planning, control of environment, etc;

c) to provide export availabilities and technical compatibility of industrial products under mutual trade; and

d) to render assistance to national users in selection of import products.

Recently, ISO in collaboration with UNESCO has established an International Information Centre on Standards in Information and Documentation (ISODOC) to help promote the availability and the application of standards by:

a) Collecting, evaluating and storing information on standards, draft standards and other relevant normative documents in the area of information and documentation and related fields;

b) Disseminating the above materials by publishing specialized bibliographies and other appropriate listings;

c) Teaching of standardization and project advice; and

d) Undertaking any other work which is deemed necessary to promote the availability and application of standards.

The Centre which would function as a permanent institution would establish close contacts with appropriate national and international organizations particularly the IFLA. It would provide a useful service to the information community especially for the successful implementation of the UNISIST programme.

The national standards body of USSR (GOST) has made considerable progress in establishing an automated information retrieval system relating to standardization (AIRS). Under the bilateral agreement for scientific and technical cooperation, ISI is collaborating with GOST in this area. Currently a Russian Team is in town to hold discussions with Indian specialists in the following fields:

a) Basic principles of developing AIRS including formats and codes,

b) Methodology for developing retrieval languages for AIRS,

c) Methods for constructing a thesaurus for indexing standards,

Conclusion

We in ISI have not computerized our information retrieval operations except for keyword indexing of ISI Handbook of Publications. But this is touching only the fringe of the problem. Now that the stage is set for launching the National Information System in Science and Technology (NISSAT) in the country, this Institution as the National Information Centre on Standards within the framework of NISSAT, will have to streamline and computerize its retrieval system to meet the needs of various sectors of the economy. Plans towards this end are being formulated and with the help of the resources and the know-how available in the Electronics Commission, Department of Science and Technology, INSDOC, and other sister organizations, we hope to establish the expanded facilities in the not too distant future.

PAPER D-1

INFORMATION SYSTEMS IN THE FIELD OF NUCLEAR SCIENCE AND TECHNOLOGY, WITH SPECIAL REFERENCE TO LIBRARY & INFORMATION SERVICES OF BARC AND ITS ROLE IN THE DEVELOPMENT OF ATOMIC ENERGY FOR PEACEFUL PURPOSES IN INDIA

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1 *INTRODUCTION*

11 Man's technological advance has been in proportion to his ability to extract energy from his environment and convert it to productive purposes. The history of energy sources is characterized by the constant replacement of one energy source by another; new and better fuels have come into use before resources of existing fuels were depleted. Wood was largely replaced by coal and hydro-power towards the end of the 19th century and more recently, by oil and natural gas.

12 A new source of energy of incalculable constructive as well as destructive potentialities was discovered in 1939 by O. Hahn & F. Strassmann when they bombarded uranium with neutrons which resulted in the fission of uranium-235 atoms and release of energy. The convertibility of mass to energy in accordance with Einstein's famous equation $E = mc^2$ was thereby proved and a new source of power became available to the world at a time when the first twinges of anxiety about the adequacy of other energy resources were being felt. The atomic age dawned on December 2, 1942 when E. Fermi, in a squash-court at the University of Chicago, U.S.A., triggered off the first ever self-sustaining nuclear chain reaction and controlled it. The first atomic power station supplying electricity for industrial purposes was built in the U.S.S.R. and put into commission on July 27, 1954.

13 The constructive atom has already opened the flood gates of economic prosperity and scientific and technological progress undreamt of before. The ever-increasing number of atomic power stations springing up all over the world, extensive use of radioisotopes - one of the offshoots of atomic energy - in agriculture, industry, biology, medicine and research, bringing forth with it immense benefits to mankind, and many other applications are some of the examples of the constructive potentialities of the atom. By the end of 1974, 154 atomic power stations were operating in the world producing 54,743 MW(e) of electricity.

2 ATOMIC ENERGY IN INDIA

21 India was one of the first countries to enter the nuclear field, credit for which goes to the late Dr. Homi Jehangir Bhabha, the first Chairman of India's Atomic Energy Commission (AEC), who, with his dynamism, foresight, scientific talent and unbounded energy, not only firmly built the infrastructure of nuclear research and development, but also made India one of the leading countries of the world in the nuclear field.

22 India's atomic energy programme is wholly devoted to peaceful applications of atomic energy, such as production of electricity through atomic power stations, building research reactors for research in various scientific fields and production of radioisotopes for a variety of applications and the peaceful uses of nuclear explosions.

23 The progress in the nuclear field in India can be broadly traced through three phases. The first phase, extending upto 1956, emphasised the training of scientists and the creation of scientific groups under the leadership of competent scientists who could, with appropriate facilities and considerable freedom of work, produce excellent work and develop the basic expertise. The Tata Institute of Fundamental Research, Bombay, has played a significant role in this phase. The second phase, extending upto 1964, saw the development of the know-how and technologies. It marked the growth of the Atomic Energy Establishment at Trombay as the national centre for research and development work in various disciplines of nuclear science and technology. The third phase sees the utilisation of the knowledge and expertise acquired for the economic development of the country through atomic power projects and public sector industries based on the technology developed at Trombay and the other units of the Department of Atomic Energy (DAE). The national centre for research and development in the nuclear field was established at Trombay in accordance with the decision of the AEC taken on January 3, 1954 and was formally inaugurated by the late Prime Minister, Jawaharlal Nehru, on January 20, 1957. It was renamed as Bhabha Atomic Research Centre (BARC) on January 12, 1967, in memory of Dr. Bhabha. The Centre is one of the largest of its kind in the world with a staff of about 10,000 of whom some 3000 are scientists and engineers.

24 India's progress in the atomic field has been very impressive. Appendix VI gives various atomic energy establishments in the country. It is not intended to dwell at length on our achievements in this field, in this paper. It is noteworthy that already our achievements have started contributing to the development of our national economy. Electricity from two atomic power stations, namely, Tarapur and Rajasthan, has been flowing into the regional grids. A large variety of radioisotopes are being produced and used in agriculture, industry, medicine and so on, and are also exported. Expertise and technical know-how gained in various areas such as electronics, heavy water, nuclear materials etc. are being used to set up large-scale industrial plants. The Library & Information Services of BARC, by promptly supplying all the available information and data to the scientists and engineers, needed in their research and development work, through its documentation, information and other services, has certainly played a vital role in all these achievements.

3 IMPORTANCE OF NUCLEAR INFORMATION AND DOCUMENTATION SERVICE

31 It is almost an axiom that an effective information and documentation service is indispensable for scientific research to keep abreast of the rapid developments taking place all over the world. The service should be speedy and efficient to save the researchers' time. The advances in the nuclear field have been extremely rapid with the result that 85,000-90,000 publications such as journal articles, conference papers, technical reports, theses, patents, books etc. falling within the broad discipline of nuclear science and technology appear every year and this number is increasing exponentially. Nuclear Science Abstracts, the most comprehensive abstracting journal in the field, listed only 2,500 items in 1948, the first year of its publication and 66,236 items in 1974 - nearly 25 times that number. The total number of scientific and technical publications to-day itself is conservatively estimated at 2.5 million !

4 INFORMATION SYSTEMS IN THE FIELD OF NUCLEAR SCIENCE AND TECHNOLOGY

41 The crucial importance of atomic energy prompted many advanced countries to set up their own information systems in the field at an early stage. By the middle of the nineteen sixties, a number of abstracting and indexing journals, fully or partly devoted to nuclear science and technology, existed in the world. The following are the most representative among them:

Nuclear Science Abstracts
Chemical Abstracts
Biological Abstracts
Index Medicus
Isotope Titles
La Propriété nucléaire - Brevatome
Le Bulletin signalétique de CNRS, sér. Physique;
  Chimie et technologie nucléaires
Index de la littérature nucléaire française
Physics Abstracts
Referativnyj Zhurnal, ser. Fizika; Khimiya;
  Biofizika, Radiatsionnaya Fizika, etc.

42 Among the large national information systems covering nuclear science and technology, are the following :

(1) Technical Information Program, United States Energy Research and Development Administration (USERDA), Oak Ridge, U. S. A.

(2) Central Research Institute for Information, Technical and Economic Studies on Nuclear Science and Technology, Moscow, U. S. S. R.

(3) Le Service de Documentation, Centre d'Etudes Nucleaires de Saclay, Commissariat a Lenergie Atomique (CEA), France.

(4) Zentralstelle für Atomkernergie Documentation (ZAED), Karlsruhe, Federal Republic of Germany.

(5) Division of Technical Information, Japan Atomic Energy Research Institute (JAERI), Tokai, Japan.

(6) Library & Information Services, Atomic Energy Research Establishment, (AERE), Harwell, United Kingdom.

43 The Euratom Nuclear Documentation System (ENDS) of the Centre for Documentation (CID), European Atomic Energy Community. (Euratom), Luxembourg, is the largest computer-based information system in the nuclear field in the world. Operational since 1967, its nuclear data base consisting of over 1.5 million items covering the period 1947-1972 has been built up from Nuclear Science Abstracts and items selected from about 100 abstracting periodicals. The System now contains INIS data base also. It provides reprospective searches and SDI services.

431 Apart from the work of developing automatic documentation system, the CID publishes directly or in co-operation with outside bodies, a number of scientific and technical publications which are listed below :

(1) Euratom reports containing the information yielded by Euratom's research programme.

(2) Euratom Information - multi-lingual monthly periodical which gives the brief summaries of published Euratom reports, the subject matter of contracts signed and patents granted and the main lines of the research programme adopted by the Commission.

(3) Euratom Bulletin - A quarterly periodical aimed at keeping a wider public informed of the Euratom's activity in the atoms-for-peace field.

(4) Transatom Bulletin - a monthly periodical which lists the translations (into English or into Community languages) of documents of nuclear interest published in the more remote languages (Russian, Japanese etc.).

(5) Nuclear Medicine - a monthly edition of EXCERPTA MEDICA, published in co-operation with Euratom.

44. The only truly international information system in the field of nuclear science and technology is the International Nuclear Information System (INIS) established by the International Atomic Energy Agency (IAEA) in Vienna, Austria, in April 1970. Because of its great importance, the System is dealt with in some details later in this paper. The United States nuclear information system, which is the most comprehensive of its kind in world to-day, is also described briefly.

45 U.S. Nuclear Information System : The United States Atomic Energy Commission, now known as U.S. Energy Research and Development Administration (USERDA), an agency of the U.S. Government established in 1947 with major responsibilities for research, development and production in the field of nuclear energy, has since its inception operated a comprehensive nuclear information system to support its own research programmes and to meet its responsibility for the dissemination of nuclear information to the population at large. The System has been centered at the Technical Information Centre in Oak Ridge with major information activities located in the multi-purpose national laboratories and has provided effective control of and access to the technical, research and development reports produced in the AEC programmes; it has provided extensive abstracting and indexing services covering the world's scientific and technical literature from the specialist view point of nuclear science and technology. Its semi-monthly abstracting journal 'Nuclear Science Abstracts (NSA)' is the principal medium for the dissemination of bibliographic information and is the most comprehensive abstracting journal in the field. The subject scope and other details of USERDA's Technical Information Programme and NSA are given in Appendix II and III.

451 An interactive computer retrieval net-work called AEC/RECON has been used since 1970 as the principal information retrieval programme. The System was originally developed by Lockheed's Palo Alto Research Laboratory for NASA. RECON systems are now in use by many Government agencies in the U.S. The European Space Research Organisation operates a RECON system in Europe.

452 The technical information base is now broadened to cover all energy-related research and development. There are now over 450,000 items on nuclear science and technology at TIC accessible by computer.

46 International Nuclear Information System (INIS) : In order to meet adequately its statutory obligations to foster the exchange of nuclear information amongst its Members, the International Atomic Energy Agency proposed the creation of the International Nuclear Information System. The proposal was approved by the Board of Governors and subsequently by the General Conference of the IAEA. INIS was established in Vienna, Austria, and became operational in April 1970.

461 The main objective of INIS is to improve and expedite exchange of nuclear information among nations of the world on the basis of multi-lateral cooperation and to avoid wasteful duplication of efforts in the field. It also aims at meeting the information needs of the developing countries and helping them to train their scientific and technical personnel, thus establishing an adequate infra-structure for their work in the peaceful uses of atomic energy. It is essentially a mission-oriented information system covering more or less the entire field of nuclear science and technology. INIS subject scope is given in the Appendix IV. The uniqueness of INIS lies in its document backup service which, unlike other information systems, makes available all the non-conventional literature inputted to it through its Clearinghouse.

462 INIS has amply demonstrated the UNISIST concept whose ultimate goal is the establishment of a flexible and loosely connected net-work of information systems based on voluntary cooperation. UNISIST is concerned initially with basic sciences, applied sciences, engineering and technology, but will be later extended to other fields of knowledge - all such systems forming its sub-systems. INIS seeks to interface with these sub-systems in an effort to interchange or exchange input or output products. This calls for a high degree of compatibility, as inputting is a decentralised operation. In view of this, INIS lays strong emphasis on maximum possible computerisation for both input control and retrieval. This means that the participating Members are responsible for collecting, procuring and preparing the input of all items falling within the INIS subject scope published in their countries in the standard machine-readable form readily acceptable for computer processing. The INIS Section at Vienna acts as the co-ordinating body and as a processing centre for checking and merging the inputs received. Various operations involved in this process are indicated in the INIS work-flow chart given in the Appendix V. The following are the various INIS output products:

463 INIS Atomindex: This is a computer-produced bibliography issued semi-monthly, both in magnetic tape format and its printed version, containing bibliographic descriptions and descriptors for all items reported to INIS. The references, including English and original language titles, are grouped by subject and listed alphabetically by author within each subject category. Each issue includes a personal author index, a report number index, an index of corporate entries and a subject index. Cumulative indexes are issued twice a year. For publishing this journal, an IBM-370/145 computer and Linotron-505 computer-controlled photo-composition equipment are used. From January 1976, Atomindex will contain the abstracts also and will thus become a full-fledged computer-produced international abstracting journal in the field of nuclear sciene and technology. With the publication of this journal, Nuclear Science Abstracts is most likely to cease publication. An experimental issue of the journal was brought out in September this year. Table 1 gives nuclear literature coverage by NSA and Atomindex during the period 1970-1975.

Table 1

Coverage of Nuclear Science Literature by NSA and INIS Atomindex - A Comparative Study

Year	NSA	INIS Atomindex	Remarks
1970	53080	4053	First year of INIS Atomindex
1971	60298	10425	Annual rate of growth was maintained at 100% or more
1972	60848	20862	
1973	62137	56757	
1974	66236	63669	Almost catching up with NSA
1975(Oct. end)	57535	51607	

464 Abstracts on Microfiche : Every item reported to INIS is accompanied by an abstract, in one or more of the official languages of the Agency (English, French, Russian and Spanish), but usually in English. These are issued in microfiche form only and are numbered and sequenced according to their corresponding citations in the INIS Atomindex. This service will cease from January 1976.

465 Non-conventional Literature on Microfiche : About 25% of all the items reported to INIS relate to non-conventional literature e.g. reports, conference preprints, patents, theses etc. Full copies of these are made available, against payment, on microfiche only.

466 INIS Reference Series : This is a set of documents containing the rules, standards, formats, codes, authority lists etc. on which the System is based. These currently consist of 15 documents. They are in accord with the existing and developing international standards to ensure the widest compatibility.

467 Presently, 45 Member States and 13 international and regional organisations are participating in INIS. The INIS Data Bank contains now some 2,14,000 items. The largest contributor to the Bank is the United States - about 40%. The other major contributors are the USSR, the UK, the Netherlands, the Federal Republic of Germany, Japan, France and India. India ranks 8th among the major contributors to INIS and about 2% of the INIS data bank consists of Indian items. In 1974, some 63,700 items were inputted to the System. The number of items produced in the world at present falling within the INIS subject scope is estimated at 85,000 – 90,000.

468 INIS was created in a spirit of international co-operation and continues as a co-operative venture for the benefit of all countries. This is the first international, decentralised, computer-based information system which provides scientific and technical information on atomic energy to users on international scale, with a broader coverage and higher precision and speed than is possible in a purely national system, and with minimum expense at the national level. The success of INIS will no doubt prompt the setting up of similar international information systems. Already, the Food and Agriculture Organisation (FAO), in close collaboration with INIS and making full use of INIS expertise and software, has set up AGRIS (International Information System for Agricultural Science and Technology) which went into operation in January 1975. Yet another system called DEVSIS - international information system in the field of economic and social development - co-sponsored by IDRC, ILO, OECD, DESA, UNDP and UNESCO is under intensive study at present.

47 INSPEC service provided by the Institution of Electrical Engineers, U.K., offers internationally accepted completely integrated computerised services in the areas of physis, electro-technology, computers and control which has made possible: (1) computerised production of INSPEC abstract journals (2) a range of new services of magnetic tapes, SDI and archival files for on-line retrieval (3) a series of cooperative interconnection programmes.

5 LIBRARY & INFORMATION SERVICES OF THE BHABHA ATOMIC RESEARCH CENTRE

51 The planning and organisation of the Library & Information Services (L & IS) of the Bhabha Atomic Research Centre was done to achieve the following objectives: Initially, to meet the information needs of the Centre's scientists and engineers as fully and expeditiously as possible; later on, to extend its services to the sister institutions, organisations and projects under the Department of Atomic Energy and finally, to other institutions and organisations in the country so far as their information requirements in nuclear science and technology are concerned. The methods adopted are to be conventional, with the gradual introduction of computerisation to the extent desirable taking into consideration the availability of our vast manpower, including technically qualified one, and the obvious need for its utilisation. In other words, the computerisation should not result in any drastic reduction in the number of personnel already employed and required to be employed in the future, but it should improve the speed, accuracy and consistency of the services offered.

52 The philosophy underlying the planning of the L & IS is that it should be a completely integrated unit under a single administrative control to ensure its smooth and effective working to fulfil its basic objectives and functions, and should be equipped with the facilities needed to provide all services to meet the information needs of BARC's 50 scientific divisions and sections which have about 7000 scientific and technical personnel. The organisation chart of L & IS is given in Appendix VI.

6 LIBRARY

61 The Library complex consists of the Central Library, the Depository Library and the Divisional Libraries.

62 Central Library : This has now some 85, 000 books and bound volumes of journals covering all the scientific disciplines in which research and development work is carried on in the Centre and to this collection 5000 to 6000 new books and bound volumes are added every year. The Library subscribes to 1300 important technical and scientific journals in the nuclear and allied fields. Besides, 320 journals are received either gratis or on publications exchange basis. The Library facilities are made available for 12 hours a day and on all days except 16 holidays observed during the year.

62 Divisional Libraries : In addition to the Central Library, the Centre's scientific divisions have small libraries containing essentially books and other publications which are needed for day-to-day reference.

63 Depository Library : One of the most comprehensive libraries in the country and the only one of its kind,and one of the largest in the world in the nuclear field is the Depository Library comprising scientific and technical reports of various atomic energy organisations in the world, procured mainly on the basis of bilateral publications exchange agreements. These reports are

both in full-size and microform i.e. microfiche, microcard and microfilm. The reports are made available, on request, to any institution or organisation on loan. In case there is a great demand for a particular report, Xerox copies of it are made and kept in the Library for loaning so that institutions or individuals requiring it need not have to wait for long. Every year some 35,000 to 40,000 new reports are added to the existing collection of about 350,000. In view of the wealth of information contained in the report literature, which is extremely useful to the scientists in their work, a concerted effort is being made to procure from all known sources every significant report so as to make the Depository Library as complete a report literature collection as possible in respect of reports published in the field of nuclear science and technology.

64 Patents, Standards and Reprints Collection : This has some 25,000 patents, standards and reprints of papers procured partly in response to specific requests from the Centre's scientists. On an average, 2,000 new items are added annually to this collection.

65 Procurement Procedure : As the Library is research-oriented, the procedure adopted for the procurement of publications is as follows : the scientific divisions of the Centre have been grouped under seven Groups. Each Group has a Library Committee consisting of senior scientists. The recommendations for books, journals and other publications are made by these Committees which are considered by the Main Library Committee and expeditious action is taken on its decisions. Any scientific worker, whatever may be his status, can make suggestions for the acquisition of books, journals or any other publication for the Library and these suggestions are implemented, if approved by the Main Library Committee. This is perhaps the most rational approach to the procurement of publications, as the Library thereby truly reflects the interests of practically every person in the Centre engaged in research and development work and meets his requirements.

66 Budget : The present annual budget for the procurement of books and journals is Rs. 12 lakhs. The budget is increased every year to meet the rising demands. Every effort is made to acquire the publications recommended with the maximum possible speed and after acquisition, the publications are quickly processed so as to make them available to the scientists with minimum delay.

67 The Library catalogues, routines and services are mainly of the conventional type. However, a detailed study has been made to see to what extent these could be computerised and a beginning has been made in computerisation.

68 Inter-Library Loan : With the object of utilising, as fully as possible, the nuclear literature existing in the libraries of various universities, national laboratories and scientific institutions and organisations in the country, an inter-library loan service was initiated in 1960 which makes it possible to get on loan material needed by our scientists which is not available in our Library. This is a reciprocal arrangement and our Library, on its part, loans publications required by other libraries on a short term basis.

681 Other libraries which have large collections of nuclear literature are those of Tata Institute of Fundamental Research, Bombay; Saha Institute of Nuclear Physics, Calcutta; Physical Research Laboratory, Ahmedabad; Bose Research Institute, Calcutta, and National Science Library, INSDOC, New Delhi.

682 Some other instituions and organisations having fairly good collections of publications in the nuclear field are: National Physical Laboratory, Delhi; National Chemical Laboratory, Poona; National Metallurgical Laboratory, Jamshedpur; Geological Survey of India, Calcutta; Indian Cancer Research Centre, Bombay; Indian Institute of Radiophysics and Electronics, Calcutta; Central Electronics Engineering Research Institute, Pilani; libraries of some of the universities and the Indian Institutes of Technology and the National Library, Calcutta.

7 DOCUMENTATION AND INFORMATION SERVICES

71 The L & IS offers practically all the services of a full-fledged documentation/information centre such as indexing, abstracting, current awareness services, SDI, compilation of subject bibliographies, retrospective searches, reprographic service, publications etc. and also participates in an international information system, i.e. International Nuclear Information System. While most of the services are of conventional type, some are computer-based.

72 Among the conventional services are: (1) Current Awareness Service on Reactors - Part I and Nuclear and Neutron Physics - Part II (monthly) (2) Nuclear Information Bulletin (Quarterly) - This contains information on nuclear topics collected from various sources and grouped under convenient subject headings for quick reference.

73 Computer-based Services : It has been difficult to cope up with the ever-increasing demands of the users, with manual methods. It was, therefore, decided to computerise some of the services, within the framework of the policy of L & IS. Consequently, a Computer Unit was formed, with staff members having adequate training in computer programming and systems analysis, to identify the areas involving jobs of repetitive nature and clerical routines, for computerisation.

731 The present activities of the Computer Unit are : (a) development and use of a local IR system for the in-house computer facility (b) machine-readable input preparation for INIS and utilization of its output tapes (c) use of European Nuclear Documentation System (ENDS) for literature search, and (d) maintenance of a reference collection in the computer field.

732 A system called "Automation for Storage and Retrieval of Information (AFSARI)" has been developed for SDI service. It is also used to produce two current awareness services, namely, "Bibliography of Current Reports" (BCR) and "List of Additions", giving bibliographic data on reports and books added to the Library. The AFSARI system consists of several programmes written in COBOL language for the Honeywell-400 computer of the Centre's Computer

Facility. The AFSARI system is used for SDI for the last one and half years. The SDI is at present limited to report literature received in the Depository Library, with some 75 user profiles. The user profile reflects the 'group' requirements for information rather than 'personal' ones. The SDI list in the form of a computer printout is sent to the user, along with a feed-back form. The user is requested to indicate his comments on the relevancy of the documents retrieved for his query. On receipt of his comments, his query profile is changed or modified for the next computer run.

733 The output tapes received from INIS can be used for SDI services, retrospective searches, subject bibliographies etc. Due to non-availability of a compatible computer, the output tape processing has not been done so far. However, the benefits of INIS output tape service are given to the Centre's scientists through our participation in European Nuclear Documentation System (ENDS), Luxembourg. ENDS has been developed by the Centre for Information and Documentation (CID) of the Commission of the European Communities and has been operational since 1967. The System has some 1.5 million documents in its data base which includes all Nuclear Science Abstracts from 1948 to 1972 and the INIS Atomindex. It is one of the very few centres in the world where almost a 'complete' nuclear data base is available. The L & IS utilizes the System's 'literature search' service by sending it requests from BARC scientists for specific literature search and normally, within 2 to 3 weeks the output containing the bibliographic description, along with photocopies of abstracts, is received from ENDS. It is then sent to the scientists concerned and in return, the duly filled-in feed-back study forms indicating the relevancy of documents retrieved, are sent to ENDS. Presently, 30 user profiles are maintained and on each search of INIS Atomindex, computer printouts of references and photocopies of their abstracts are received.

734 Apart from the books and periodicals available in the Library on computerized information processing, the Computer Unit maintains a large collection of reprints, Xerox copies of articles and a few reference manuals in the field. The collection covers various aspects of computerized information processing, working and experimental systems, descriptions of some systems and standard tape services and their utilization.

74 Translation Services: The publication of a substantial proportion of nuclear literature (about 40%) in languages other than English, makes it imperative that such literature be made available to our scientists. An appreciable number of our scientists do possess an adequate knowledge of one or more of the languages: French, German and Russian while very few know other European languages and Japanese. Although the Russian scientific literature is being translated into English on a fairly large scale, particularly in the United States, still a good part of it remains untranslated. Besides, there is a considerable time-lag between the publication of the Russian papers, reports etc. and the availability of their translations.

741 With a view to providing expeditiously the English translation of important non-English nuclear literature to our scientists, a Translation Unit was set up at the very inception of our nuclear programme. This Unit at present has six language experts handling mainly French, German, Italian, Rumanian, Russian and Japanese.

742 An irregular publication entitled 'Translation Bulletin' is brought out for internal circulation which gives bibliographic data on the papers, reports etc. which are fully translated by the Translation Unit. On an average, about 300 papers, reports, etc. are translated every year.

75 Technical Publications: The Publication Unit is responsible for editing, printing and distributing BARC technical reports, proceedings of symposia, conferences etc. held under the auspices of the DAE and BARC and other technical publications such as lecture notes on specific subjects, brochures etc. In-house Xerox, offset, letter-press and binding facilities are used for this purpose. The reports fall broadly under three categories, namely, : (1) restricted reports which are circulated only to a few individuals in the Centre. (2) reports meant primarily for circulation within the Centre and sister institutions under the DAE, and (3) reports both for internal and external circulation. On an average, 130 to 150 publications of all categories are brought out every year. Besides, over 400 papers are published annually in both Indian and foreign journals, presented at national and international conferences, symposia, seminars etc. The reports are brought out as speedily as possible and sent to various atomic energy organisations in the world on bilateral publications exchange basis, and also national laboratories, scientific organisations and universities in the country.

76 Technical Information : There is considerable interest in and enthusiasm for atomic energy and its manifold applications among the educated masses, particularly students and teachers, as reflected by scores of queries received by the L & IS. The Information Unit handles all such queries and makes available pamphlets, brochures and other publications on our atomic energy programme to stimulate the interest. Queries received from foreign countries about Indian atomic energy programme are also handled by this Unit.

77 Reprography : The Reprographic Unit consists mainly of Xerox machines, both imported and indigenous ones. This Unit, in conjunction with the Offset-printing Unit, is used for the production of various BARC publications. The Unit also has a Rank Xerox/1824 Printer and a 3 M Reader/Printer for producing full-size copies from microfiches and microfilms requested by the scientists. Besides, there are several microfiche, microfilm and microcard readers.

78 Micrography : There is a Kodak MRD-2 microfilming camera and microfiche making equipment supplied by the Atlantic Microfilm Corporation, USA, which are used for microfilming documents and also preparing microfiches of BARC publications.

8 INIS OPERATION IN INDIA

81 In conformity with her policy of supporting any venture aimed at fostering international co-operation, India was one of the first countries to join INIS and has been since actively participating in it. As the national inputting centre for INIS, the L & IS is responsible for all INIS operations in the country. From the very outset, 'Operation INIS' was systematically planned and executed. Important tasks undertaken during this operation can be summarised as follows:

i) Identifying and collecting nuclear science literature produced in the country.

ii) Selecting and processing the material thus collected in a systematic manner for preparing the input for transmission to the INIS Section in Vienna on a regular basis.

iii) Developing professional competence for preparing the input in machine-readable form.

iv) Organising speedy dissemination of merged input data by generating useful by-products.

82 For achieving these objectives, an INIS Cell of experienced documentalists with sound scientific background was set up. This Cell undertook the study of the INIS system and conducted a survey of the available sources of nuclear literature in the country. Subsequently, a small working group, namely, INIS Group of subject and documentation specialists was formed, two of whom also possessed a good knowledge of information processing by computer. Incidentally, the first INIS seminar 'Regional Seminar for Asia and the Far East on Input Preparation for INIS' was held in BARC from November 23 to December 11, 1970 and it proved very useful in providing the basic training to the members of the INIS Group in all aspects of input preparation. Besides this general training, two members of the INIS Group were deputed for 'on-the-job training' in Vienna for 4 to 6 months. As a part of this training, the members were also given an opportunity to visit some important nuclear information centres in Europe and the U.K. During the course of the training, the members attended the INIS Training Seminars held in Vienna and Karlsruhe on various aspects of INIS.

83 We began sending input on worksheets. However, since June 1972, after the acquisition of a Friden flexowriter Model 2303-I, the input has been prepared on paper tape in machine-readable form. From October 1975, INIS planned to incorporate machine-readable abstracts on output tapes. Consequently, inputting centres have been asked to supply the abstracts in machine-readable form viz. on magnetic tape or paper tape or OCR mode. Our abstracts are now sent on paper tape as the input data is also being sent in this form.

84 According to an estimate, some 1,500 - 1,800 documents falling within the INIS subject scope now originate in India annually. Of the journal papers, over 70% are published abroad and therefore cannot form part of the Indian input for INIS. We endeavour to collect and input as much of the nuclear literature published in the country as possible. The average annual input by India so far is about 2% of the total world input to the INIS Data Bank and is probably more than the inputs from all other developing countries put together. The following Table gives India's input to INIS till Nov. 1975:

Table 2

INDIA'S INPUT TO INIS DATA BANK

Year	Indian Input (Cumulative)	Total world input (Cumulative)	% of input from India in INIS Data Bank
1970	151	4,053	3.7%
1971	386	14,478	2.6%
1972	1000	35,340	2.8%
1973	2230	92,097	2.8%
1974	2980	1,55,765	1.9%
1975 (upto Nov.)	3900	2,14,000	1.8%

85 We utilize the output products distributed by INIS by subscribing to 10 air-mailed copies of Atomindex, plus 2 copies received free of charge, and abstracts on microfiche of all the items. The printed Atomindex is widely circulated among our scientists for speedy dissemination of information. Non-conventional literature available in microfiche from the INIS Clearinghouse is procured in response to individual requests. However, on account of the non-availability of a compatible computer in BARC, for that matter in the Bombay region, it has not been possible so far to utilise the INIS magnetic tape for starting services such as SDI, retrospective literature search etc.

Library & Information Services of BARC, which is a need-based mission-oriented information system, is characterised by its comprehensiveness, dynamism and sound organisation, and is the most unique of its kind in the country. Among the main factors which enabled L & IS to attain its present status are: (1) sound and realistic planning (2) hard and dedicated work put in by the members of its staff (3) environment of research and development activities of BARC and (4) active participation in its activities by the Centre's scientists. L & IS is now looking forward to active participation in the National Information System for Science and Technology (NISSAT).

U. S. Energy Research and Development Administration (USERDA)
Division of Technical Information Extension (DTIE)
Technical Information Program
Oak Ridge, Tennessee, U. S. A.

Date Established	1946
Description of System	The TECHNICAL INFORMATION PROGRAM is a centralized documentation center for the USERDA and as such it collects, catalogs, abstracts, indexes and disseminates information in the field of nuclear science and technology. It also provides reference, literature searching, publication and microfiche services.
Subject Coverage	Nuclear and nuclear-related information.
Input Sources	Journals, technical reports, USERDA engineering materials, books, theses, monographs, patents, translations, and conference literature from world-wide sources.
Serial Publications	Nuclear Science Abstracts (semi-monthly); Technical Progress Reviews (quarterly); Isotopes and Radiation Technology, Nuclear Safety, Reactor Technology.
Non-serial Publications	The following publications are issued irregularly: Engineering Materials List (TID-4100); Standard Distribution for Unclassified Scientific and Technical Reports (TID-4500); Index to Conferences Relating to Nuclear Science (TID-4043); Report Number Codes Used by the USERDA Division of Technical Information in Cataloging Reports (TID-85); Corporate Author Headings Used by the USERDA (TID-5059); USERDA Translation Lists; Subject Headings Used by the DTIE (TID-5001); Publication Exchanges of the USERDA (TID-4554); Bibliographies and research and development in progress, e.g., Controlled Fusion and Plasma Research (TID-3557); Bibliography on Nuclear Medicine (TID-3319); Research and development in progress, e.g., Summaries of the USERDA Basic Research Program in Chemistry; (TID-4051); Research and Development of Progress - Biology and Medicine (TID-4060); Serial Titles Cited in Nuclear Science Abstracts (TID-4579).
Microform Services	USERDA and other U. S. agencies' technical reports are available in microfiche form to the public from National Technical Information Service.
Other Services	Abstracting and indexing; card service (Limited to ERDA contractors); computer and manual literature searching; consulting; cooperative programs; copying; depository program for selected libraries that purchase microfiche; microreproduction; reference and referral services; research; systems analysis and design; translation.
User Restrictions	Information contained in USERDA technical reports and announced in NSA are within the public domain.

U. S. Energy Research and
Development Administration (USERDA)
Division of Technical Information Extension(DTIE)
Oak Ridge, Tennessee, U. S. A.

Date Established	Publication of Nuclear Science Abstracts began in 1948.
Description of System or Service	NUCLEAR SCIENCE ABSTRACTS (NSA) began in 1948 as a semi-monthly publication of the U. S. Atomic Energy Commission. It provides abstracting and indexing coverage of the world's literature in the fields of nuclear science and technology. The literature included is indexed by subject heading-modifier combination and descriptors.
Subject Coverage	Nuclear science and technology.
Input Sources	Theses, reports, conference papers and proceedings, books, and articles from over 2,000 scientific journals.
Serial Publications	Nuclear Science Abstracts (semi-monthly) - available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.
Non-serial Publications	Subject Scope of Nuclear Science Abstracts (TID-4552) Corporate Author Headings Used by the U. S. Atomic Energy Commission in Cataloging Reports (TID-5059) Subject Headings Used by the USAEC, Division of Technical Information (TID-5001); Report Number Codes Used by the USAEC, Division of Technical Information in Cataloging Reports; Descriptive Cataloging Guide (TID-4577) Subject Modifier Guide, Manual for Composing Section (TID-4578) Guide to Abstracting for Nuclear Science Abstracts (TID-4576) Serial Titles Cited in Nuclear Science Abstracts (TID-4579).
Magnetic Tape Services	Subject heading-modifier indexes have been computer stored since 1962, descriptor indexing since 1968. Both files are machine searchable for information retrieval.
Other Services	Abstracting and indexing; computer and manual literature searching; reference and referral services; translation; consulting.
User Restrictions	Service is available to any subscriber.

INIS SUBJECT SCOPE

PHYSICAL SCIENCE

General Physics: mathematical and general theoretical physics; atomic and molecular physics; solid-state and fluid physics; plasma physics and thermonuclear reactions; astrophysics and cosmology, cosmic radiation; direct energy conversion; low-temperature physics

High Energy Physics: elementary particles (theory); elementary particles (experimental)

Neutron and Nuclear Physics: neutron physics; radiation physics; nuclear theory; nuclear properties and reactions

CHEMISTRY, MATERIALS AND EARTH SCIENCES

Chemistry: chemical and isotopic analysis; inorganic, organic and physical chemistry; radiochemistry and nuclear chemistry; radiation chemistry; corrosion; fuel processing and reprocessing

Materials: metals and alloys (production and fabrication); metals and alloys (physical properties and structure); ceramics and cermets; other materials; radiation effects on physical properties of materials

Earth Sciences: land; water; atmosphere

LIFE SCIENCES

All Effects and Various Aspects of External Radiation in Biology: effects of external radiation on biochemicals, and on cell and tissue cultures; effects of external radiation on microorganisms; effects of external radiation on plants; effects of external radiation on animals; effects of external radiation on man

Radionuclide Effects and Kinetics: tissue distribution, metabolism, toxicology and removal of radionuclides; radionuclide ecology

Tracer Studies in Life Sciences: novel tracer techniques

Applied Life Sciences: plant cultivation and breeding; pest and disease control; food protection and preservation; animal husbandry; other applications of radiations and radioisotopes in life sciences

Health, Safety and Environment: actual radiation accidents; radiation hazards and safety evaluations of nuclear installations; radiation protection standards; radiation protection procedures; personnel dosimetry and monitoring

ISOTOPES, ISOTOPE AND RADIATION APPLICATIONS

Isotopes and Radiation Sources: production of enriched uranium; production of heavy water; other isotope production, separation and enrichment; radiation sources; radiation source metrology

Isotope and Radiation Applications: power production; industrial applications, rad
metric; industrial applications, radiation processing; tracer techniques

ENGINEERING AND TECHNOLOGY

Engineering: thermodynamics and fluid flow; cryogenics; structures and equipme
nuclear explosions; handling of radioactive materials; accelerators (whether for
particle research or not); materials testing

Nuclear Reactors (General); reactor theory and calculation; reactor components a
accessories; reactor fuels; reactor control systems

Specific Reactor Types and Their Associated Plants: power reactors, non-breedi
light-water moderated, boiling water cooled (bwr etc. types); power reactors, no
breeding, light-water moderated, non-boiling water cooled (pwr etc. types); powe
reactors, non-breeding, graphite-moderated (gcr, agr, htgr etc. types); power
reactors, non-breeding, otherwise moderated or unmoderated; power reactors,
breeding; research and test reactors, including experimental reactors (zero-powe
reactors and subcritical assemblies) and training reactors; production reactors (p
ducing fissionable materials), irradiation reactors such as chemonuclear reactors
isotope production reactors, tritium production reactors, materials testing reacto
material processing reactors; mobile, propulsion, transporatable and package
reactors

Instrumentation: particle and radiation detection and measuring instruments and
methods; other nuclear instrumentation and methods of measurement; radiation eff
on instruments, components or electronic devices

Waste Management: waste treatment; waste disposal

OTHER ASPECTS OF NUCLEAR ENERGY

Economics: nuclear power economics; fuel cycle economics; economics of isotope
and radiation applications

Nuclear Law: radioactive materials; nuclear installations; radiation health; trans
and storage of radioactive materials; liability for nuclear damage; nuclear ships a
other nuclear means of conveyance; organization and administration of nuclear act
vities; nuclear disarmament and safeguards

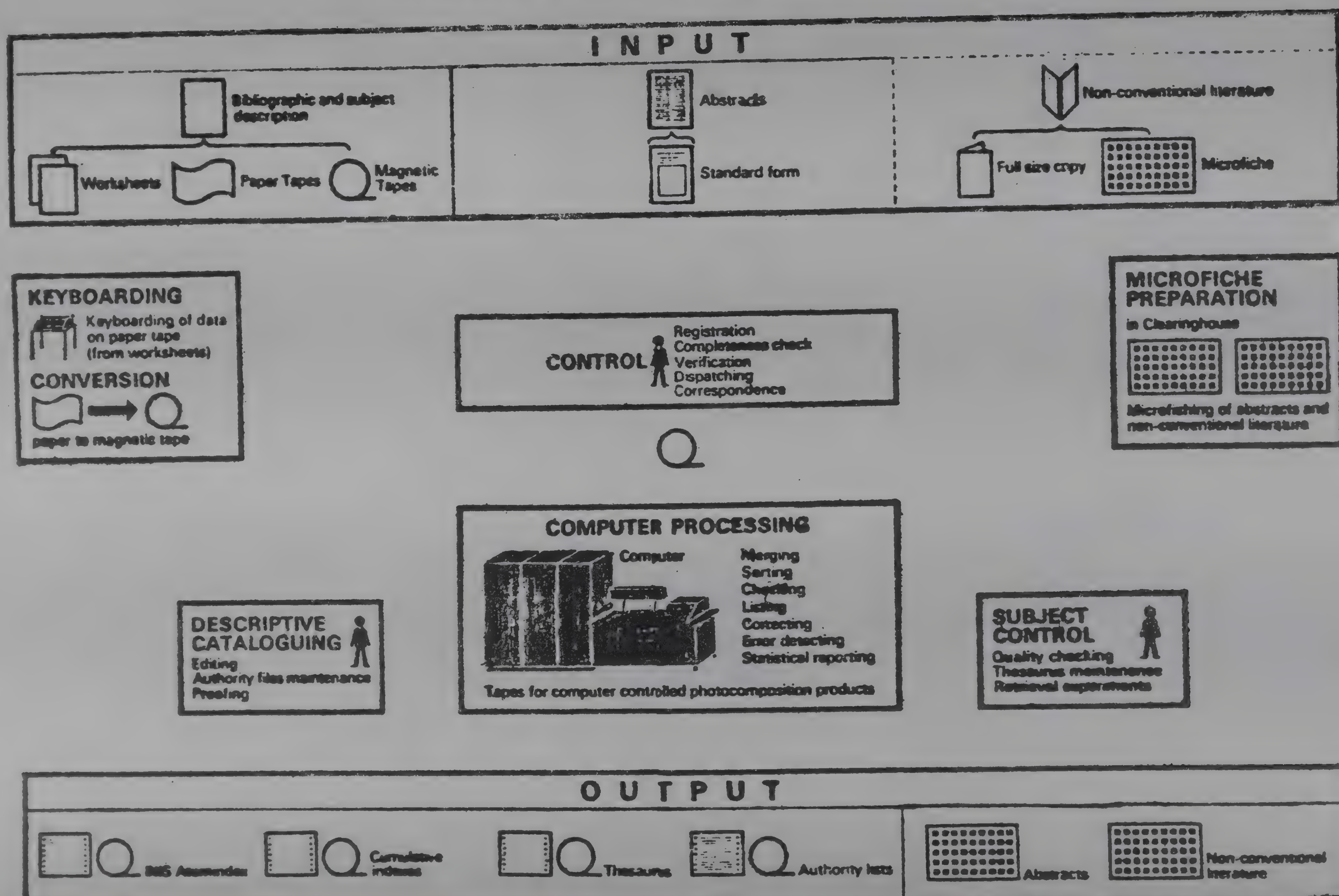
Nuclear Documentation: data handling; literature handling

Safeguards and Inspection: technical aspects; non-technical aspects

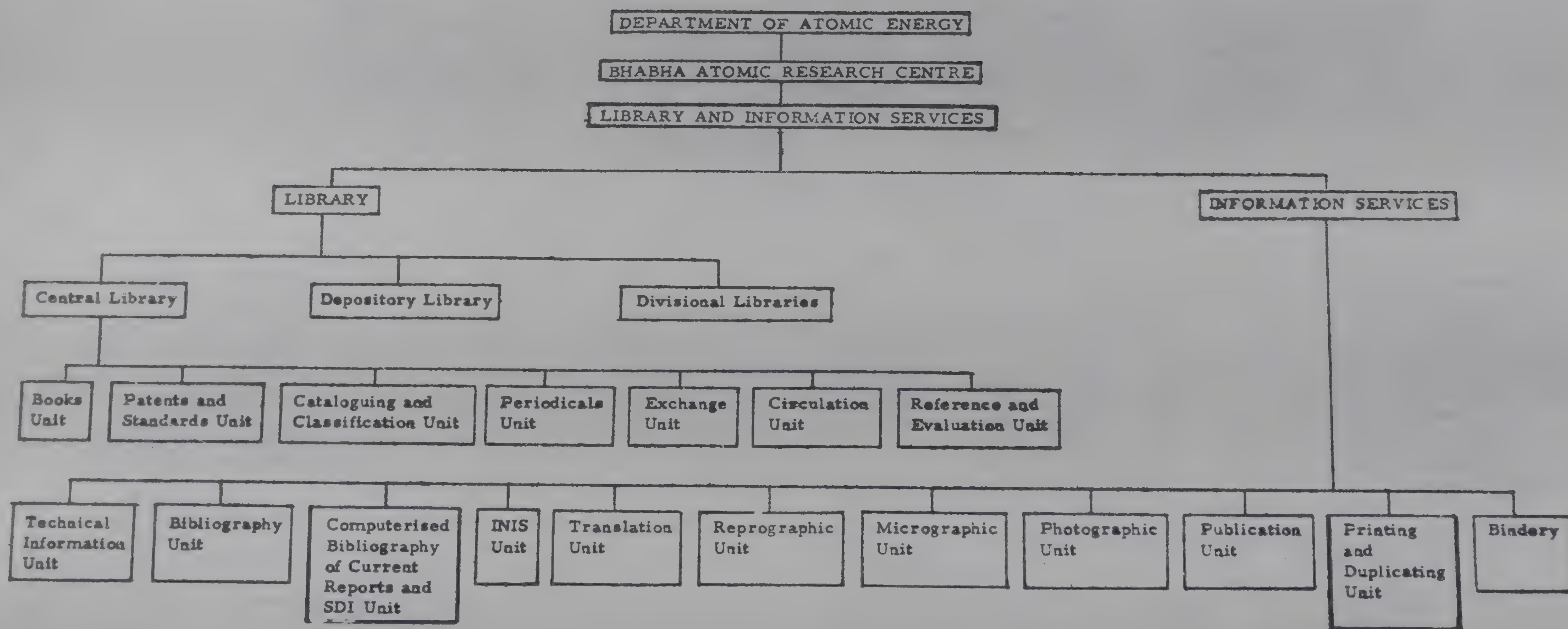
Mathematical Methods and Computer Codes: nuclear computation and simulation

Miscellaneous: general relevant documents; progress reports

INIS FLOW CHART



APPENDIX VI



ORGANISATION CHART OF LIBRARY AND INFORMATION SERVICES

PAPER D-2

CLIMATOLOGICAL INFORMATION FOR NATIONAL DEVELOPMENT

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Meteorological Office
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1 *Climatological Information*

Climate is an invaluable natural resource. It has numerous applications to every human aetivity. Design and operation of any project require climatological information. Industry demands climatological specialisation for siting, lay outs, air-conditioning, heat and light etc., while agricultural and irrigation projects require varied forms of climatological statistics for their working. Civil aviation, multipurpose hydel projects also cannot do without climatological data. Competitive maritime commerce calls for information of average weather conditions over the neighbouring seas for safe and optimum routing. Microwave towers, port installations, telecommunications, powerline projects and tall structures require information regarding maximum wind pressure at their sites to allow for safe weather tolerance.

Climatological summaries become extremely valuable and decisive for strategic and tactical planning during emergency and war. Further, by reference to climatological statistics, many controversial questions regarding the occurrence of extreme weather elements, claims about climatological changes or trends etc. can be subjected to critical examination.

2 *Climatological Records and Data in India*

Hence, one of the important functions of any meteorological service is the preservation of long period climatological records of weather archives and preparation of climatological statistics. India Meteorological Department has preserved the climatological records not only for periods after 1875 when it came into existence, but also those of earlier periods. The oldest observatory at Madras was established in 1792. It started recording meteorological observations in 1793 and these are the earliest climatological records which have been preserved at Kodaikanal Observatory. Meteorological records since 1841 have been preserved at Colaba (Bombay), the second oldest observatory in India, while records of other very old observatories have also been published and preserved for varying periods. At present the office of the Deputy Director General of Observatories (Climatology & Geophysics), Poona, is the repository of all the climatological data of the department. It is the National Data Centre for weather data in India. It has an IBM 1620 computer, Hollerith tabulator, sorter, reproducer and a number of punchers and verifiers. The CDC 3600 computer at TIFR Bombay also is being made use of for processing climatological data.

The primary responsibility for collecting the surface observational records from the departmental observatories in various States is vested with the Regional Centres at Delhi, Calcutta, Bombay, Madras and Nagpur, and the Meteorological Centres at some of the State Capitals. Observations recorded at each of the observatories are entered in standard meteorological registers. After scrutiny, the data are being transferred to punched cards and sent to Poona where climatological summaries are prepared. The upper air data are sent by the observatories direct to Poona where before punching manual methoa of horizontal and vertical consistency checks are applied to ensure the space and time consistency of the data. The daily and monthly upper air data are published separately in monthly volume by offset printing computer outputs. The data of autographic instruments of observatories are sent to the concerned RCs/MCs where they are scrutinised and then sent to Poona where mean monthly tables are published.

3 *Varieties of Data*

The following types of data are being collected and archived at Poona:-

31 *Surface*

Consisting mainly of daily synoptic observations (2 to 8 per day) recorded at nearly 500 surface observatories in the country, and hourly observations recorded by autographic instruments at nearly 100 observatories.

Synoptic surface data are being transferred to punch cards for past years. At present the transfer has proceeded backwards upto 1957.

32 *Rainfall*

Daily rainfall data of about 5000 raingauge stations in the country and autographic data of over 100 self-recording raingauge stations. Cards are available for the period 1867 to 1970.

33 *Evaporation*

Data relating to evaporation recorded at over 100 stations in the country.

34 *Marine*

Daily synoptic observations (4 per day) from voluntary observing fleet of Indian Registry now numbering 225 are collected from Ships Logs and transferred to punch cards. They are available in this form from 1946 onwards. In addition, from 1961 onwards punch cards of ships' observation for the Indian Ocean north of 15°S are received on punch cards from various countries whose merchant ships ply over these waters. India functions as a Marine Data Collection & Processing Centre of WMO for this area. The number of cards containing ships' data since 1961 is 1,156,000.

35 *Agro-meteorological*

These consist of simultaneous observation on crop growth and meteorological observation of temperature, wind, cloud, rainfall, dew, evaporation, soil moisture etc. recorded at a number of observatories attached to agricultural farms (about 125 stations). Cards are available for the period 1944 up-to-date.

36 Aeronautical

Hourly and half hourly observations from all principal airports and current weather observatories. These comprise parameters like pressure, temperature, humidity, wind direction and speed, visibility, cloud and rainfall. Punch cards are available for 10 years 1955-64.

37 Upper air

All data of upper air temperature, pressure, humidity, wind direction and velocity at standard levels recorded at 19 radiosonde and 27 radiowind observatories and 74 (including naval and IAF stations) pilot balloon observatories (3 to 4 times daily) are available on punch cards since 1951.

38 Rocket Meteorology

Meteorological data of temperatures and winds collected at the Thumba Equatorial Rocket Launching Station (TERLS) near Trivandrum are available on punch cards.

391 Radiation

Hourly observation of global solar radiation and diffuse sky radiation at 14 stations are being collected. Effective long wave out going radiation and total solar radiation from sun, sky and earth data are also being collected. These are all available on punch cards.

392 Atmospheric physics

Total Ozone, atmospheric electricity, micro-meteorological observations, air quality and pollution characteristics are also recorded at a few stations in the country and their data are being collected.

India Meteorological Department has got raw data on punch cards amounting to 25 millions. The punch cards are preserved in specially designed steel trays with pressure plates so that they may retain their original quality of being useable in card readers and data processing machine. Original records and such derived forms of data contained in them as are appropriate are archived in specially designed cabinets. 2. 5 lakhs of punched cards are subjected every month to stringent quality control with machine and manual edit. The new technology of electronic automation provided by IBM 1620 computer at the IITM Poona and the CDC 3600 computer at TIFR Bombay is pressed into service for checking initial consistency of data and quick preparation of climatological summaries for feed-back to national and international users. Surface and upper air data are summarised into useful statistics.

4 National Data Centre of Poona

In order to preserve very old records and publications a microfilm unit forms part of the National Data Centre.

The National Data Centre at Poona meets the requirements of national and international users to the best of its ability. There are plans to acquire a modern third

generation computer to meet the urgent need for modern data processing abilities. It is planned to transfer the large number of cards on magnetic tape with the help of computer in order to assure a compact and quick data storage and retrieval system and reduce the demand of space for increasing bulk of punch cards which deteriorate rapidly with time and become unusuable after some years.

Paper D-3.

DEVELOPING A NATIONAL INFORMATION SYSTEM IN THE FIELDS OF HEALTH, MEDICINE AND FAMILY PLANNING

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1. *Introduction*

One of the main reasons why man has come to be the dominant species of the spaceship earth is the fact that humans have been endowed with the capacity to communicate with each other with uncanny accuracy, so that concerted efforts may be made to better the life of the community. Natural barriers to communication existing from antiquity like distance, time, language, dialect have more or less been conquered by human ingenuity with its major achievement of evolution of written speech and translation. The documents which carry written speech not only communicate with persons in far flung areas but also serve as our link with the past and the future. The progress in this regard has added a new dimension to the problem and that is of 'volume'. So much information is being generated, so many ideas are being expressed that it is now impossible to absorb even a fraction of the same. The reader has to be selective so that his most precious asset 'time' is not whiled away in useless pursuit of information which is of little relevance. Out of this need of taking the proper information at the proper time to the proper person, has grown the art and science of Documentation as a part of Information System network.

Let us analyse the process of human work, work dedicated to survival, growth as well as prosperity. The process is basically the same whether it is a housewife working on a meal,or an engineer working on a dam. The steps logically are awareness of an imperative need, assessment of the potential available, study of utilisation of resources under similar circumstances by others, planning, execution and assessment of the results with the ultimate objective of learning from experience.

The bigger the task, bigger are the magnitudes of information necessary at all levels. Further needs are specific, but information available on the subject may not be the same. The whole purpose of information system is to provide for specific information promptly when required.

Development or socio-economic progress has a good indicator in the health services. For proper utilisation of human resources, and for proper fulfilment of human desires, a state of good health is vital, health in this context being defined as by WHO "as a state of complete physical, mental and social well-being and not mere absence of disease or infirmity".

Health is intimately associated with nutrition and environment. It is a human virtue to take care of its sick. Family Welfare Planning is linked with health services and at present would appear to be a vital component of developmental strategies.

Our national Government since 1947 have paid attention to comprehensive health development, and instituted a number of national programmes for assuring community health.

All this calls for decisions at all levels with different magnitude of financial implications, and the decision to be correct can only be taken in the background of current situation and current knowledge provided by accurate information system. Thus the need for a documentation centre providing accurate, uptodate and specific information cannot be over emphasized.

In this paper, it is proposed to study the magnitude of the need, both with regard to information and persons needing the same. The present system as it exists is scant and inadequate, but should also be examined so that plans for future development fully utilise the resources already developed and build upon the same to meet the challenges of a dynamic development programme.

2. *THE NEED OF DIFFERENT CATEGORIES OF PERSONNEL*

The information to be supplied by Documentation Centres to be meaningful must be tailored to the individual needs of the clientele. While it is not possible to make pre-planning for all the individual needs, it is possible to categorise the individuals and ascertain the type of services that will be needed by them. The individual needs will be mostly in this range, but for exceptional cases special individual steps may have to be taken.

There are 4 broad groups of personnel in the field of Health, Medicine and Family Planning requiring services as follows:

1. Persons concerned with decision making process.
2. Persons concerned with implementation of the programmes - both official and voluntary agencies.
3. Persons concerned with teaching, training and research.
4. Miscellaneous groups.

The more important a person is in the decision making hierarchy, less in the time he can spare for perusal of documents. The information base may be extensive, but the same will have to be condensed to the essentials in a clear, coherent and comprehensive manner indicating the source for further reading if necessary. The varying needs will also have to be categorised in order of priorities, and this will call for decision making in the centre itself. Thus the personnel required in a documentation centre should not only be those responsible for collection, categorisation and maintenance on the one hand, and those concerned with retrieval, reprography and dissemination on the other, but also with those who can condense information into compact documents, containing all the essentials.

21 *Persons concerned with Decision-making Processes*

The persons concerned with decision making processes require uptodate information on current situations, trends, in their own domain as well as in allied and

related fields. They also require information on past experiences and on similar situations elsewhere in the world. Such personnel can be sub-grouped as:

i. Policy makers and Planners, usually officers of Planning Commission and Ministries.

Information has to be provided to them on current issues (factual, public opinion,etc.) in extremely condensed manner which must be very accurate, along with experience of others facing similar problems and further indicate current trends of thought on the subject.

ii. Such top level personnel are usually supported at a lower level by officers who are concerned with giving information, clarification and attend meetings as officers on attendance. They require more detailed information and actual statistical figures, and lists of studies on a particular issue like bibliographies and location lists and selected reproductions for their own individual study. Actually in the present set up, they prepare the note or memorandum for consideration by the decision makers. Thus a specialized service for the higher level may apparently seem to be redundant, but in actual practice it is not so, as an outside look on momentous issues is always worthwhile.

iii. Political and social leaders, irrespective of affiliations should also have relevant information on issues of interest, so that they may criticise and guide public policies in the right directions. Social organisations concerned with giving voluntary services should have information, so that their limited resources are utilised in the most competent manner. These group of people would require annotated bibliographies, and articles containing information and viewpoints. Thus their needs are in between the above two sub-categories.

22 Persons concerned in Implementation

The services of the Documentation/Information Centre are required by two categories:

i. The programme administrators, like top officials of the programme, e.g. Directors, Project Directors,etc. Though these personnel act within the broad guidelines set up by decision and policy makers within the broad programme plan, they have to adjust the machinery according to exigencies of circumstances and also give feedback to the programme.

ii. The other category of personnel are those in direct contact with the field personnel acting in supervisory capacity. They are in a position to spot snags and report for corrective action. For this, they have to be alert and on the look out for snags which have appeared elsewhere in similar situations, how they have been tackled and with what result. Thus their need will be about field problems at micro and medium level, better methods of motivation and service on all aspects of family health.

Again the need will depend on job specifications, which in the field of Health, Medical Care and Family Planning may be as:

a. Trainers
b. Communicators - Health educators, motivators.

c. Service personnel - Medical Staff, auxiliary staff.
d. Research/Evaluation personnel -
Biomedical, demographic, sociologists anthropologists, media officers.

23 Persons concerned in Teaching, Training and Research

i. Senior faculty, concerned with planning, guidance in execution, evaluation and write up of research processes.

ii. Junior faculty concerned with carrying out of research projects.

iii. Students and research assistants.

iv. Teachers.

v. Technical staff.

As a rule, the research workers will be interested in research reports and original work, whereas teachers will be more interested in current thoughts, reviews of literature as well as in newer audio-visual aids and in teaching technology. The researchers will be primarily interested in bibliographies, reprints, annotations and abstracts, Medlars/Medline services, whereas teachers will be interested in proceedings of conferences, symposia, workshops, monographs, manuals, book reviews, etc., though there will be a considerable amount of overlap. This is the total group which uses and will use services of a documentation/information centre most extensively. The interest of the research group will also include translation services.

24 Miscellaneous Group

It is difficult to categories lone person, who due to one reason or other require information on health, medical care and family planning aspects. It may be a lone physician asking for information on a specific problem, or an entrepreneur thinking of the market before venturing in drug, or nutritional- supplement industry.

3. *EXISTING FACILITIES*

The existing facilities in India are of crucial interest to us but today cooperation between regional countries and international agencies bridge many gaps which otherwise would not be filled for years to come. Awareness of such facilities stimulate their full utilisation. A brief description of facilities available in India will be followed by a description of state-of-art in other countries, and finally about available international aids.

31 Situation in India

A documentation information system to be fully active should have clearly identified personnel in need of their services (category wise) in 'Directory' form. The directory will also help members of group to identify each other in their respective fields of specialisation. This is of utmost importance in avoiding unnecessary duplication of efforts. The documentation/information system should have a good library base to draw upon information. They may prepare acquisition lists, bibliographies, annotations of both regularly published as well as fugitive material and send the same to relevant groups. This should be backed by reprint service. Further

from time to time reviews of allied papers, books, etc. may be brought out either as separate volumes or as parts of regular issues of journals. Thus a good documentation/information network will have:

i. good library base
ii. documentation service
iii. reprography

Such a situation does not exist anywhere in the South East Asia Region dealing with health, medical care and family planning problems at a national level.

In India, the nearest approximation may be possible, if resources of National Medical Library, Library of All India Institute of Medical Sciences, and activities as well as resources of newly started documentation centre of National Institute of Family Planning (NIFP) are integrated. The NIFP is considering convening a workshop of related agencies to work out the frame work of such a setup.

The facilities and services available at present are:

i. National Institute of Family Planning

The Institute library prepares bibliographies, directories on research and training facilities, annotated lists of recent additions to the library, index of current literature based on periodicals, press clippings,etc. The documentation centre has started functioning in a rudimentary way and has prepared its first set of questionnaires and abstracts to identify its clientele. The centre when fully functioning, will provide abstracts of papers and books, index, bibliography and translation services. It will also attend to specific queries.

The library and documentation centre as parts of Information and Audio-Visual Division which includes editorial and reprography sections. The reprography services will be augmented, and centre fully developed with more acquisitions aided by a grant from United Nations' Fund for Population activities. The Institute is publishing the 'Journal of Population Research', in which abstract on current topics are integral parts. The Government of India is actively considering merging the Institute with National Institute of Health Administration and Education (NIHAE), when the scope of the merged Institute will embrace all aspects of Health and Family Planning problems. At present NIHAE is bringing out a quarterly journal on public health, family planning and population and also giving some bibliography services.

ii. National Medical Library - situated just behind the ICMR buildings and adjacent to the All India Institute of Medical Sciences, the library provides reference and bibliography services to the medical profession in the country. It brings out union catalogue of medical periodicals in Indian libraries.

iii. Library of All India Institute of Medical Sciences (AIIMS)

The library named after the first Director, Dr. B.B. Dixit provides services to students, staff and research workers of all levels. The library has been enriched by donations from collections of Fuetan, Raj Kumari Amrit Kaur and Col. Amir Chand. It contains 23,000 volumes of bound journals, 37,000 books, 8,000 pamphlets, monographs and reports, and subscribes to about 500 periodicals. A considerable number

Documentation centres include:

Indian National Scientific Documentation Centre (INSDOC), Regional Documentation Centre in Human Reproduction, Family Planning and Population Dynamics of SEARO office of WHO in New Delhi, Social Science Documentation Centre of Indian Council of Social Science Research (ICSSR, SSDC) all of them in Delhi. Documentation Training and Research Centre (DTRC) in Bangalore is a research and training institute set up by Indian Statistical Institute

The following tools are available:

Indian Science Abstracts (INSDOC), Union Catalogue of Medical Periodicals in Indian Libraries (NML), Regional Union Catalogue of Scientific Serials, Delhi Medical Libraries (INSDOC), Indian National Bibliography (Central Reference Library, Calcutta), Health Statistics of India (Directorate General of Health Services, DGHS), Directories of Medical Colleges (DGHS), Directories of Hospitals in India (DGHS), Directories of Specialised Treatment Centres in India (DGHS), Pharmacopoeia of India (DGHS), Indian Pharmaceutical Guide (Pomposh Publication), Indian Medical Register (Medical Council of India), Union List of Social Sciences Periodicals (ICSSR), Vital Statistics of India (Registrar-General of India).

32 Situation in Indonesia

Indonesia has made rapid strides in developing a nation wide programme of data system, in accordance with directives based on Presidential decree No. 8 of 1970 and 33 of 1972. The matter was regarded as one of great urgency to provide for comprehensive programme evaluation and review system. The data system concept embrace assistance to executives, researchers, evaluators, and help in manpower development. As a first step, uniform service statistics data system was organised in 1971 with computer processing and rapid mailing service.

In October, 1973, the initial steps were consolidated and a National Information and Documentation net work on Family Planning/Population was constituted. The Micro thesauraus of Carolina Population Centre was translated to Indonesian. The agency worked in close collaboration with East-West Centre at Honolulu, ESCAP as well as Carolina Population Centre.

In two years the network procured the hardware, some 5000 titles, fugitive material (2000), periodicals (12) and prepared a directory of special libraries. It is producing list of publications, accession lists, bibliographies, journal of research findings, technical reports, area reports, current awareness service,etc. It has worked out reader-profiles and an information dissemination system.

It has also developed a plan of action for 5 years development of the network to include manpower development, induction of new units and subunits in the system, production of union catalogues, assessment of future needs, development of material collection, study of dissemination and utilisation and evaluation of network services.

33 Situation in Thailand

Bangkok, which appears to be the focal point of development is also the seat of UN-ESCAP, population division clearing house and information section.

of back volumes of journals have been procured. Services provided includ reference on demand, bibliographies and photo-duplication.

iv. Institute for Research in Reproduction, Bombay

It provides reprint services to researchers on biomedical aspects of population and family planning.

v. Central Health Education Bureau, New Delhi

The CHEB Library has brought out a select bibliography on health education and another on audio-visual aids.

vi. Institute of Rural Health and Family Planning, Gandhigram

The library provides reference services to researchers and trainees of the Institute.

vii. International Institute for Population Studies, Bombay

The library publishes a quarterly acquisitions list and compiles bibliographies on fertility and family planning.

viii. Family Planning Association of India, Bombay

The Association publishes a quarterly journal called Journal of Family Welfare (English) and a monthly newsletter - Planned Parenthood.

ix. Office of the Registrar General India, New Delhi

The Library issues acquisition lists (quarterly), serial list and bibliographies, such as bibliography of social studies in India.

In addition to all these, there are Central Training Institutes (total 7 including NIFP), 44 Health and Family Planning Training Centres, 12 Demographic and Communication Action Research Centres located in academic institutions and universities, a number of important and special institutes like Post-graduate Institute of Medical Education and Research (Chandigarh), Jawaharlal Institute of Post-graduate Medical Education and Research (Pondicherry), All India Institute of Physical Medicine and Rehabilitation (Bombay), All India Institute of Hygiene and Public Health (Calcutta), All India Institute of Speech and Hearing (Mysore), National Tuberculosis Institute (Bangalore), All India Institute of Mental Health (Bangalore), Hospital for Mental Diseases (Delhi), Central Leprosy Teaching and Research Institute (Chingleput), Central Bureau of Health Intelligence (Delhi), V. Patel Chest Institute (Delhi), Haffekin's Institute (Bombay), Tropical School of Medicine (Calcutta), etc; of these the first two are general libraries, whereas others are devoted to their own specialities. In addition there are 105 medical colleges, all with libraries. Thus relatively speaking there is no dearth of material, and a broad base exists for development of a National Documentation - Information network in an integrated manner.

Most of the data system is based on universities of Chulalongkorn and Mahidol as well as National Institute of Development Administration. The Institute of Population and Social Research (Mahidol Unit) has a proposal to strengthen its library and a data bank using a computer.

34 *Other Adjacent Countries*

In Nepal, a country with a population of about 12 million, there are about 10 major libraries.

Bangladesh, which came into being as an independent sovereign country on 16 December, 1971 has a population of about 75 millions and an alarming population growth rate. The medical colleges, and national organisations like Bangladesh Family Planning Board, Bangladesh Family Planning Council, Bangladesh Family Planning Association, Directorate of Training, Research, Evaluation and Communication have their libraries but all in rudimentary stages with no sizeable collections. A central documentation service is visualised which may be based on Bangladesh Institute of Developmental Studies.

The situation in Srilanka is at slightly more advanced stage, the Family Planning Association being a very active one. Library facilities exist in Ministry of Health, Institute of Hygiene, Govt. Ayurvedic Training College, and also in Institute for Training of Nurses. There are two university medical faculty libraries in Colombo and Peradeniya, and a medical library with Srilanka Medical Association. The Regional Office of International Planned Parenthood Federation (IPPF) is located in Srilanka.

Thus, there is a great scope of development of an information network in the whole of South East Asia Region. This is of importance, not only because the problems are similar, but also as diseases, specially of infective nature do not usually halt at the borders.

35 *International Regional Facilities*

There are two very important international regional centres: one in New Delhi located in the Regional Office of South East Asia of the World Health Organization, and the other at ESCAP Population Division, Clearing House and Information Section, at Bangkok.

The library at SEARO of WHO embraces all relevant topics, related to health, medical care and family planning, but its documentation centre is on 'Human reproduction, family planning and population dynamics'. The library collects books, periodicals, indexing and abstracting periodicals, fugitive materials, and has good liaison with ESCAP, Bangkok; Carolina Population Centre, Chapel Hill; Harvard Centre for Population Studies, Massachusetts; Information Population Programme of George Washington University; (all in U.S.A.), East-West Centre, Honolulu; and IPPF, London. Further the library provides Medlars-Medline services through WHO headquarters at Geneva. A number of bibliographic and reference material have been produced. 'An aid to the teaching of human reproduction, family planning and population dynamics' is revised annually. Four annotated bibliographies on (i) Steroid Contraception; (ii) Family Planning Programmes; (iii) Male Reproduction and Fertility Contro; and (iv) Intrauterine Devices have been brought out. Its information dissemination area embraces Bangladesh, India, Indonesia, Nepal, Srilanka and Thailand.

The ESCAP Clearing House is actively engaged in improving channels of communication in the Asian and Pacific Region with regard to population problems. It is estimated that the region covered contains 58 per cent of world population with annual growth rate of 2.5 per cent.

The second Asian Population Conference, held in Tokyo, 1972 recommended specific tasks in field of exchange of population information. The Centre attempts to cater to these and has included research among its activities. The research is not only of diagnostic type in order to recognize need or scope of activities, but also on bibliography control system, and evaluation.

The ESCAP has identified key institutions and personnel and has developed an Asian network of population correspondents. Its translation service, a very important component of its activities was based on a diagnostic research embracing 671 organisations and a study of the same will be a rewarding experience for any one interested in information experiments (See SEA/F.P. Dec. Sem-16-SEARO-WHO, New Delhi).

36 *Other International Facilities*

The 'Index Medicus' is the largest indexing periodical covering 2400 periodicals. The National Library of Medicine (Bethesda, Maryland, USA) started a programme for access to biomedical literature in 1879. In 1962, the library started to develop computerized system for producing 'Index Medicus' which became operational in 2 years time. The system was decentralised by establishing a network of MEDLARS (Medical Literature Analysis and Retrieval System) in USA and some other countries like Australia, Sweden, U.K., and what is most important to us in WHO, Headquarter at Geneva.

The data base of MEDLARS on magnetic tapes include some 200,000 references from 2400 important biomedical journals and can be searched by computer for rapid composition of bibliography on a specified subject.

The Medical Subject Headings (MeSH) is the basic indexing and searching tool with about 8000 headings with 60 sub-headings like diagnosis, occurrence, advance effects etc.

Medlars services are now available on line and called "Medline" services. To utilise this service, it is necessary to have access to a Medline terminal. The WHO - Headquarters Library is linked with computer data base at National Library of Medicine. If one has an access to a teletypewriter attached to the terminal, one can get immediate information.

The WHO service can be availed of by a request to WHO-SEARO library or to headquarters library direct using a form, copies of which are available free of cost to health administrators, medical, health and research institutions, and medical and research workers in the field.

Population Information Programme at George Washington University, called 'PIP' has two components:

i. Publications on Contraceptive technology, summarising recent developments in well documented, well illustrated format. This is essential for any collection on population and is available free.

ii. Retrieval System 'Popinform' on a data base containing literature and statistical data including programme, evaluation and demographic statistics. It may becoma a part of Medline service under a separate head.

Another computerised information service is located in Technical Information Service (TIS), of Carolina Population Centre at University of North Carolina, Chapel Hill, USA. This service is available on mail request. Data base is the TIS library having 30,000 articles in social, psychological, demographic aspects of family planning, including policies, administration, evaluation, communication, manpower development,etc. Documents are only available to researchers. Requests are to be sent to the reference librarian, who mails the lists. Photocopies of selected papers are provided on request.

The entire catalogue of TIS is available in microfiche and can be used wherever microfiche readers are available.

The other sources of information are International Planned Parenthood Federation; Population Council, New York; East-West Communication Centre, Hawaii; Committee for International Coordination of National Research in Demography (CICNRED, Paris); Karolinska Institute, Stockholm; and Population index of Princeton University, U. S. A.

4. *PLANS FOR THE FUTURE*

How do we visualise an Information network?

There are three components involved:

1. Acquisition
2. Analysis, Storage, Retrieval, Reproduction
3. Dissemination

41. *Acquisition*

Any constructive activity is need-based and we have examined the catagories of personnel in need of information and the type of information required. We have also reviewed the existing facilities.

As we have seen that maximum of information is generated abroad and we have access to the same through international agencies. Any library or individual may avail of services free of cost or at a low cost, provided he knows where to apply.

Collection of such materials is costly and much of the money spent in gathering such material may be utilised in gathering information not available through such sources. The difficulty is about getting information about articles published in languages other than English. The ESCAP is looking after S.E. Asia region and provides translation services which may be of interest to us. One hopes the needy will also have access to articles published in languages like Chinese, Japanese in years to come.

The idea of national information network on Health, Medical Care and Family Planning is favoured. This network should have institutional and individual correspondents for gathering information, and should have link with all available international

information centres. It may have as its base the relatively well equipped libraries of Delhi and the Documentation Centre at NIFP. The institutions and correspondents may be identified to carry out the following functions:

i. Government correspondents at all levels - to notify about developments in Government policies, personnel changes, legislation, health and family planning intelligence and also answer specific queries.

ii. Academic correspondents should give information about new research projects, data on freshly concluded projects, or progressive data on ongoing schemes, also on available facilities and problematic situations.

iii. Academic bodies and societies - Information about meetings, changes in staff, proceedings of conferences, workshops, seminars along with all papers presented, and also in identifying persons in need of information.

iv. Press correspondents and persons interested in social work to provide news, newspaper clipping, expressed public opinion, and also about important events in related fields likely to have repercussion on Health, Medical Care or Family Planning.

Both academic correspondents and institutions may help with translation services as well.

The cost with this system, when a person or institution takes up correspondence work in addition to routine duties is likely to be minimal.

42. *Analysis, Storage, Retrieval, Reproduction*

A national information network system to be really effective should have comprehensive information which is classified and can be retrieved easily and made available promptly. One can learn from lessons of development of other large information systems. A first step will be development of subject headings. If information is received in precoded forms giving technical details (filling of which should be easy after consulting a manual), storage will be easy. In any large scale operation a computerised storage may be most economical in the long run and assistance for same may be available from international agencies as a part of developmental plans.

Till such time, improved technology takes over, usual library classification and thesaurus use will have to serve.

The information may be sought from computer by computer access terminal in central and state headquarters, important national organisations and ultimately in all districts. It has been predicted that computer costs will fall, and a computer access terminal may cost about 50 U.S. dollars in times to come. (See SEA/FP/Doc. Sem/12-SEARO-WHO). All these may be done in phases.

Till such time, one may ask and obtain specific information either by telephone or by mail.

The reproduction of information either for an individual or for a group calls for microfilm photocopying and mass-reprography services.

43 *Dissemination*

Dissemination should be research based by identification of the individuals and their usual needs. Relevant directories and mailing lists are to be prepared and evaluation studies undertaken from time to time. The dissemination of information should include reference services, annotated bibliographies, conference reports, calender of courses, book review, etc., and specific information to queries.

The importance of correct, comprehensive and timely information cannot be overemphasised in developmental processes. The returns are high on investments in terms of costly mistakes avoided. We have a good base which can be supplemented by linking with other international information systems. With a good organisation and use of modern technology. one can build upon the existing base to provide a worthwhile information service system. At least the time is now ripe when we should seriously look into the possibilities.

ACKNOWLEDGEMENT

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PAPER D-4

TOWARDS THE EVOLUTION OF AN INFORMATION SYSTEM FOR NATIONAL WATER RESOURCES EVALUATION, DEVELOPMENT, MANAGEMENT AND PLANNING

N.K. Sonavane and V.N. Amble

1 *Introduction*

The Central Water Commission (C.W.C.) has a pivotal role to play in the assessment, planning, development and management of national water resources. The C.W.C. has the general responsibility of initiating, co-ordinating and furthering, in consultation with the State Governments concerned, schemes for the control, conservation and utilization of water resources throughout the country for purposes of flood control, irrigation, navigation and water power generation. One of its functions is to oversee the collection of hydrological data and arrange for their compilation, scrutiny, tabulation, processing and analysis. Data on the physical and operational characteristics of irrigation projects and their financial aspects are also compiled. The Commission acts as the national clearinghouse in respect of these data. Each type of basic data requires to be developed into a national information system.

2. Hitherto these data are mostly being stored in the conventional manner and retrieved manually. Since long term data are required by the Central Water Commission, Planning Commission and other data users for planning and development of irrigation and power, there is a need to preserve the data over a long period of time. Preservation of data in files over years becomes exceedingly difficult as a prohibitively large amount of storing space is required. Moreover the data files get torn with the passage of time resulting in the mutilation of data. The processing of data manually is slow and not very efficient. The retrieval of such data takes considerable time and involves errors of copying, etc.

3. For rapid and accurate processing and retrieval of large bodies of data the only solution is the use of electronic data processing system. Though the facilities of electronic data processing available in different organisations have been availed of in a limited way for producing water yearbooks and analysis of the data, the work did not make headway to the desired extent because of the lack of personnel and the difficulties of getting sufficient computer time from the computer centres. With the growing realisation of the need for comprehensive and efficient information systems in the water resources sector as an integral part of the agricultural and natural resources information system, efforts are being made with the help of the Electronics Commission to secure the requisite computer facilities to meet the challenge. The Electronics Commission have proposed a UNDP project for the National Information Centre

(NIC). The NIC will have a large regional computer and terminals will be provided to some of the Government departments participating in developing information systems in the field of agriculture (including irrigation), science and technology.

4. Streamflow, water levels, suspended sediment and water quality are the most important parameters used to measure and quantify the surface water resources for both resources planning projects and management activity. The system relating to the streamflow and water levels is discussed here.

There are about a thousand sites where river water levels (stages) are observed (three times a day) and there are over 1800 sites where river water levels and corresponding rate of flow of water (stage-discharge) are observed daily. For some sites data are available from the period as early as 1890. From the hydrological point of view long term data are extremely valuable and need to be preserved. These data are observed by State Government agencies, units of C.W.C. spread over the country and some other agencies. Out of these the data of about 300 sites are being collected, scrutinised and processed by C.W.C. Water yearbooks are also published for some river basins. The ultimate aim is to store, scrutinise, update, process and retrieve the data for the entire country so as to make them readily available for further analysis and research. A data system has to be made alive and responsive to the needs of the engineers, research scientists and Government authorities by providing in time all the information available that has a bearing on a particular problem.

5. A schematic description of the major elements of the information system for storage, processing and retrieval of hydrological data is given in Fig. 1. These elements are briefly discussed in the following paragraphs.

6 *Data Transmission*

The methods of transmission of data have to be improved upon to make the flow of data from various agencies to the Directorate of Statistics of C.W.C. smooth and within the scheduled time. The forms for recording of stage and stage-discharge will be standardized to make them suitable for coding and punching directly. Due to multiplicity of agencies, and since the sites are spread over the entire country, data compilation is a time consuming task. Data are observed at a site and transmitted mostly by post to the sub-divisional office where computations are done and records are maintained. The S.D.O. further transmits these data to its head office from which data are forwarded to the C.W.C. At present there is no time limit within which data must be transmitted to CWC. A suitable deadline will have to be set for the despatch of data if the data are to be made available to users in time.

7 *Pre-punching Scrutiny*

The data received in the Directorate of Statistics will be subjected to broad mannual scrutiny for incompleteness, duplication and consistency. The concerned data recording agencies will be contacted for missing data and the discrepancies detected. The data will then be coded and made suitable for rapid and accurate punching by addition of suitable directions where necessary.

About three lakhs of punch cards will be required to transfer the data of all current sites for a period of one year. It is roughly estimated that the number of punch cards required to transfer all the data of earlier periods would be of the order of 6 million.

8 *Storing and Processing of Data*

The data on punch cards will be transferred to magnetic tapes since on account of cost and other considerations, a magnetic disc is not likely to be available in the near future. The data files will have to be arranged sequentially. All data of a site will be arranged in time series and the sites will be grouped according to basin, tributary and sub-tributary. Stage and stage-discharge data will be maintained on separate files. Data of all the sites in a basin for a period of one year are also required for some studies. This is also an important sequence and master data file will be kept in this sequence. Tape layouts are not described here as the software facilities likely to be available are not finalised as yet. This system will need a programming language which is efficient both in data processing as well as in scientific applications. At present data are being transferred to magnetic tapes in card image form. From this form the data would be transferred in the desired tape layout formats. (Provisionally data for one month forms one physical record. The file in this form is currently being used for the development of scrutiny programmes, programming language being FORTRAN IV).

9 *Scrutiny and Correction*

Programmes will be developed to scrutinise the missing cards, duplicate cards, use of invalid codes, punching and other errors. The data supplying agency (D. S. A.) will be contacted for missing data and for those discrepancies which are inherent in the original data. Error messages provided by these programmes will be studied manually and correction cards file will be prepared. This file will be used to update the data file. The feed back from D. S. A. will also be used for updating the data file.

10 *Quality Check of Data*

The data file will then be subjected to various programmes which will test for the consistency and quality of the data. The functions of some of the programmes are mentioned in the following:

(a) <u>Plotting of stage and discharge hydrographs</u>: The stage and discharge hydrographs plotted side by side provide a means of checking possible discrepencies. If the water level rises there should normally be a corresponding increase in the discharge except in certain cases. (If the river cross-section is not stable, the relationship between water levels and discharges is likely to be disturbed after a high flood). The study of the stage and discharge of hydrographs should thus help in detecting some of the probable discrepancies.

(b) <u>Plotting of stage-discharge relations for rising and falling periods separately</u>: This will bring out additional discrepancies. Updating will be done accordingly.

(c) <u>Regression analysis of Stage-discharge (S. D.) relation</u>: The relation between S and D is of the form

$$D = a\ (S-S_o)^b$$

where S_o is the stage value for which discharge is zero. Since direct estimation of three parameters by least square method is not possible because of involvement of S_o, the programme will choose that value of S_o which will make the residual sum of

squares minimum in the linear regression between log D and log (S - S_o). Ninety-five percent confidence limits for the S.D. relation will be found. An outlier test will be applied for detecting additional discrepancies. However care has to be taken to consider the discrepancies after taking account of any shift in the control. Shift in control will be tested by the test of homogeneity of regression lines.

(d) Comparison of water levels of different sites in the same reach of river basin: Similar comparisons for stream flows of different sites will be made. Relations between water levels of different sites will be established. Similar relations for stream flows will also be established.

(e) Comparison of runoff volumes of water during monsoon, non-monsoon and the whole year of various sites in the reach will be made. These run-off volumes are expected to be consistent. These data are usually in great demand and would be readily provided, apart from being used for consistency checks.

11. By removing of all the discrepancies detected through the scrutiny programmes and corrections in the light of the explanations provided by the D.S.A.s a Master Data File is built up. This will be the basic data file for all future synthesis, analysis, computations, publication of water yearbooks, studies and research.

12 *Retrieval*

Water yearbook format will be finalised taking into consideration the needs of various data users and computer output in the water yearbook format will be brought out annually. Generalised search programmes would be developed to produce the required information in the desired formats. Some users may require all the available data for a site or sites in a sub-basin, or a basin. Some may require data relating to a particular project. Some may require data for a part of some basin falling in a particular State. Data may be required for a specified period or for the entire period for which data are available. All such needs would be kept in view in developing the search programmes.

13 *Decision Making*

Decision making enters in the system at various levels. Planning of water resources development and management depends on the available financial, water, expertise and other resources in the country. Prime decision making has to be done when water resources are evaluated and projected to future short-term and long-term periods.

14 *A Sub-system on Inventory of Stage and Stage-discharge Sites*

Since the number of observation sites included in this system is about 3,000 and this number will increase in the near future, an inventory of these sites giving the information for each site such as (i) name, code number of s site; (ii) type of the site (S or SD); (iii) river basin, tributary, sub-tributary to which the site belongs; (iv) State and district of location and geographical co-ordinates; (v) data supplying agency; (vi) the period for which data are available at source; (vii) the period for which data are available in the Directorate of Statistics of CWC; and (viii) the date of closure (in case of closed site) has to be maintained and updated from time to time. A computerised inventory system is being developed. A study is being conducted to collect the information regarding methods of taking observations, instruments used, etc., with a view to bring the reliability of the observed data to the International Standards and control

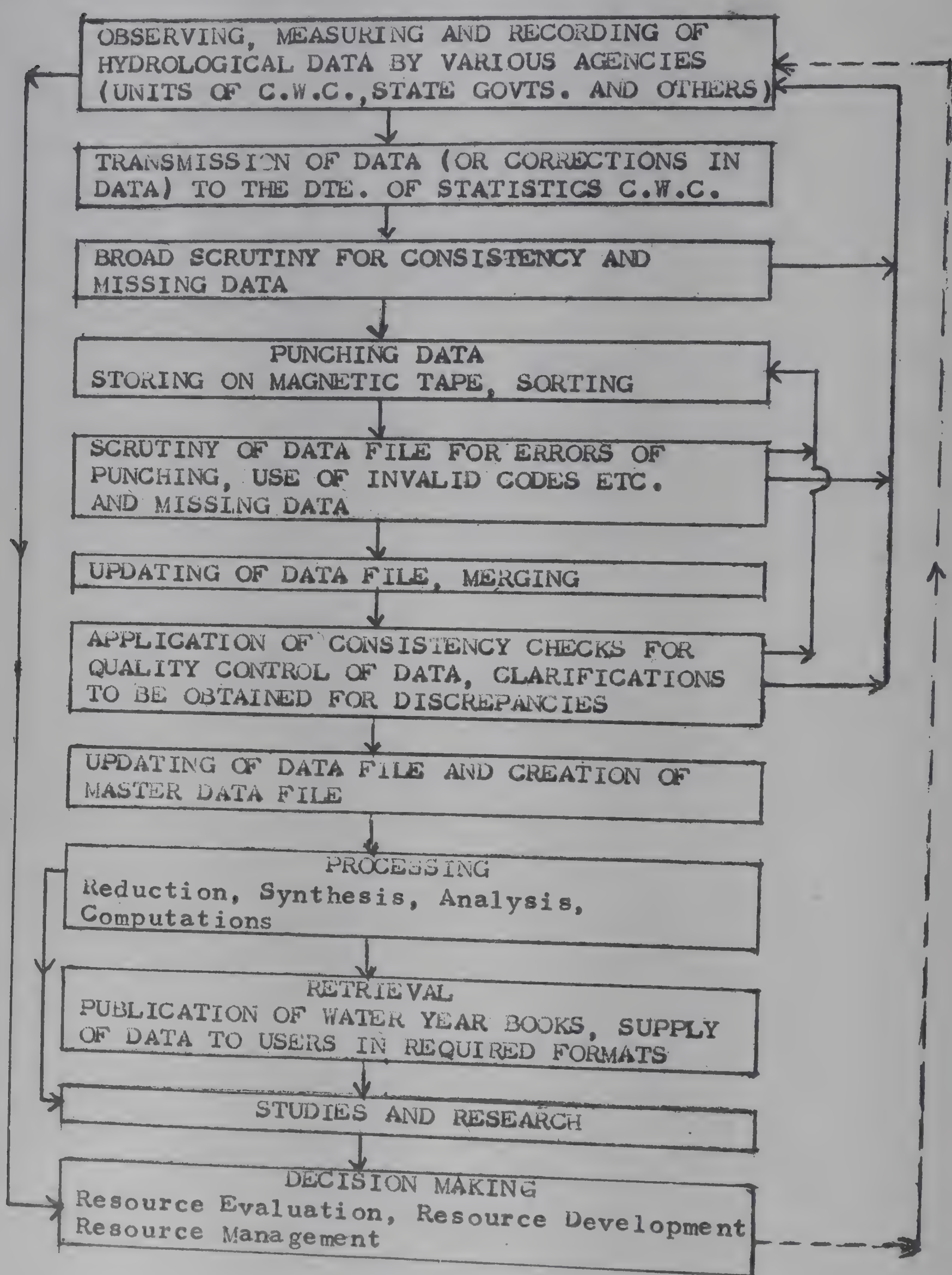
the quality of data. This information will also be included in the inventory system being developed. The inventory master file of S and SD sites on magnetic tapes, stored according to the requirements, will be able to tabulate the information of sites basin-wise, state-wise, agency-wise with any combination of further classificaticns.

15. There are other information systems in CWC which can be computerised. Flood forecasting and flood warning system can be developed as a real time computerised system. This will require, however, advanced techniques such as development of mathematical models to estimate stream flows and water levels at certain points on the basis of rainfall, flows and water levels in the upper reaches and the additional facilities of observing and collecting data by remote sensing along with the present transmission of data by wireless system. Human affliction and property worth crores of rupees can be saved from the floods if precise flood forecasting is done well in advance. This system will also simplify the decision making regarding reservoir regulations which involve the risk of wasting water and power resources against damage to the structure and flooding the area below the reservoir.

16 *Maintenance of Secrecy of the Data*

Data of some rivers have been classified as secret. No secret data are to be supplied without the prior permission of the appropriate authority. The system has thus to ensure confidentiality. Secret data can be kept on separate tapes which will not be available without appropriate authorisation. Further, a suitable procedure (which would be kept secret) of tape handling would be prepared to ensure additional safety.

Fig. 1 Schematic description of the major elements of the Information System of Storage, Processing and Retrieval of Hydrological Data



NOTE : DATA FLOW ⟶ PLANNING & PROGRAMMING - - - >

PAPER D-5

TOWARDS EVOLVING A NATIONAL INFORMATION SYSTEM IN HEALTH AND MEDICAL SCIENCES

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1 NATURE & SCOPE

The temptation to assume that everyone knows what is meant by the term "National Information System" especially in a field like "Health and Medical Sciences" is very great. Leaving aside the professional jargon, it may be defined as a mechanism for the collection, processing, analysis and transmission of information for organization and operation of education, research and practice in the field of Health and Medical Sciences. The total effort is directed towards securing effective and prompt delivery of health care to each and every individual in the nation. A comprehensive approach in promoting primary health care within the context of National development efforts was approved by the World Health Assembly and the member states have been urged to fully integrate the Primary Health Care both with the National Health System and with the other sections involved in Community development such as agriculture, education, public works, housing, & communications.

The canvas is thus very wide. Apart from the diagnostic and clinical data, we need to have demographic and environmental information, and data on morbidity, Health care needs, health resources and facilities, medical care utilization and the net result of all the health efforts. While the need for factual information in all these areas may be urgent for strategic planning for improving the Nation's health, we have to bear in mind the caution given by Fox (1973) 1 "though there is plenty of information available for comprehensive health planning, there is lack of a structured system for handling it". We therefore have to be very cautious in designing an information system which should be commensurate with the demonstrated and the anticipated demands of the biomedical community in the country. Our resources are very limited and as we all know, information services come at the lowest rung of priorities in the scheme of national development. So we have to be wise and plan our future system keeping in mind the resources available.

2 EXISTING FACILITIES

Any future system will therefore have to be built up on the existing infrastructure in the field of Health, Medicine and Family Planning howsoever inadequate it may be. The three major components of the existing system in the Health, Medicine and Family

Planning are: (i) Libraries attached to Medical Colleges, Research Institutions, Union & State Health Departments, Professional Associations and Societies, a few large Hospitals and some pharmaceutical firms, (ii) Information contained in the published literature - books and periodicals, official as well as non-official reports and documents, audio-visuals (to a very limited extent), manuscripts, and (iii) users or or clienele made up of students and teachers, research workers and practitioners, planners and administrators and large number of para - medical personnel.

3 *MEDICAL LIBRARIES*

There are over 260 Medical Libraries in the country. Most of these Libraries offer skeleton service to their clientele and suffer from all the typical disadvantages such as lack of space, inadequacy of financial support, dearth of trained staff, and the total lack of any training in the use of a library. The pace of development in these libraries is terribly slow with the result that they have not been able to create any visible impact on the delivery of Health Care in the country. The situation has been very well summed up by Dr. E. Brodman (1971) 2 "Often single handed with little support within their Organisation paid pitiful salaries, looked down on by professionals as mere clerks hemmed in by galling restrictions, and without the inspiration and support which a plentiful supply of library literature and attendance at professional meetings of a high level would give them, they still manage to serve, the cause by working hard, devising means to get around restrictions and difficulties and so gradually pursuading the members of their institutions ofth eworth of Libraries. The difficulty of getting another staff member is as great as (getting) a computer". The only redeeming feature of this otherwise dismal picture is the establishment of the National Medical Library at New Delhi. The National Medical Library is yet to take up its role of leadership in the field of Medical Librarianship, as it has not yet come out of its teething troubles.

(ii) INFORMATION CONTENT:

The information explosion which we are currently experiencing is so vast and tremendous that now both the producers and the users are finding it difficult to handle it. Medicine is indebted to so many other disciplines of which it is an offshoot. But within itself also the approach has become multi-disciplinary among various specialities. Another complicating factor is the level at which information is required - the needs of a general practitioner are different from those of a nurse or an undergraduate Medical student or a teacher or a researcher. During last two decades the output of published literature in the field of Health and Medical Sciences has become just prolific and it is beyond the capacity of the best medical libraries to acquire even a sizable portion of this literature. No doubt Medical Sciences are one of the most organized in so far as bibliographical, indexing and abstracting services - are concerned. But how many libraries in India can afford to acquire all necessary reference tools which are so expensive. We are very much aware of the poor financial position of our Medical Libraries. Another dimension to this problem is added bv the vast amount of literature which is not covered by any of the existing bibliographical aids. This is much more true in respect of Indian Literature in Health and Medical Sciences specially the indigenous systems of medicine. Not much attention is paid to cover the Health and Medical information published in non-medical publications. So the wide variety of publication media, inter-disciplinary approach, priority areas to be covered and the level at which the output is to be fed to the users are some of the important considerations which we have to bear in mind in evolving an efficient information system for our country. Yet another important factor is the availability of foreign published literature in

procuring which we spend so much time and money and whose applicability to the indigenous problems is controversial. We have just not been able to tide over this problem of speedy access to foreign published literature in India.

Apart from the published literature in the form of books and periodicals, quite an enormous data is compiled and produced at various levels. Some of the efforts to cover this data are notable such as Health Statistics of India, Vital Statistics of India, Census Reports, Survey of Current Interests in India, Annual Reports of Union and State Health and Medical Directorates. But otherwise very valuable data is created and lost in individual hospitals, institutions and departmental files as there is no central clearing house for information of such data - with the result that it is not available to potential users.

(iii) USERS:

The general apathy towards medical libraries in the country is reflected in the attitude of our Health Professionals. The practitioners usually have an attitude of being contented with their preliminary degree or diploma and very few of them keep uptodate by subscribing to one or two professional Journals. Teachers, research workers and post-graduate students who form bulk of the user community are not very persistent in demanding an effective information service to meet their requirements. The para-medical personnel are still worse off in this respect. Most of the Health Sciences Workers prefer to go without any information than pursue their efforts further, probably because they are too apprehensive of the limitations under which the Medical Library system operates in the country (Chitale and Bhatt) (3). Large number of private practitioners - doctors, hakims, vaidyas and Homeopaths have no access to any medical library worth the name, nor have they any facility of continuing their education further. How can we expect them to deliver the goods effectively if we are unable to rejuvenate them with fresh knowledge, new techniques and methods.

Professional associations and societies also have not been equivocal in demanding efficient medical library service in the country.

It seems to us that the Biomedical Community in the Country have not involved themselves in evolving a need-based efficient information system.

4 *PROPOSED SET-UP*

An ideal information net work in Health and Medical Sciences may be utopia if one considers the enormous amount of fundings, necessary for evolving such a set-up. The quick pace of scientific and technological advancement no doubt has made available the most sophisticated hard and software to herald such a system and in fact efforts are already under way in evolving BCN (Biomedical Communications Network) at the Lister Hill Centre of the National Library of Medicine, U.S.A. But we in this country are yet to achieve certain pre-requistes for the existing infrastructure before attempting any such venture. Our limitations are very obvious and we have got to work with those till we have overcome them. We will now examine these pre-requisites one by one.

(i) MEDICAL LIBRARY SYSTEM:

Needs to be toned up. Financial, administrative and professional support will have to be mustered up to bring them upto a certain desirable level where they can render effective service to their readers. A comprehensive survey of existing medical

libraries should be conducted so that a realistic libraries development plan can be drawn up. It should be undertaken by; a high level committee which should among other things explore the areas of co-operative acquisition, cataloguing and bibliographical services. The Committee should draw up a master plan for the Medical Library network in the country. It should cover local, state, Regional and National Institutions. It may be re-emphasized that user community must be involved in this survery and planning.

(ii) The recent de-recognition of Indian Medical degrees by the General Medical Council of England has caused much furore, agony and dismay in our Medical fraternity who now realise that it is time to recondition our Medical Teaching to meet our own needs rather than to provide recruits for foreign health services. Medical Library and Information Services can play a vital role in our search for knowledge and technique which is more suitable to our own problems. The Statutory Councils, like Medical Council of India, Nursing Council, Dental Council, Pharmacy Council etc. should prescribe and insist on having a minimum essential provision for Library and information services in the budgets of the Institutions in their respective areas.

(iii) HOSPITAL LIBRARIES: need to be established in every State. In the initial stages matching grant should be provided for each hospital library established by the State. Patient Libraries which are conspicuous by their absence in India, also should be created with support of voluntary Organisation where possible.

(iv) The drug industry in the country could be advised to set aside a certain percentage of their total expenditure on research and publicity for the development of their own Libraries. In fact the National Medical Library, the Drug Industry and appropriate Research Institutes can join hands to initiate a Specialised Information Service on the Drug Literature in the Country.

(v) The doors of all categories of Medical Libraries should be opened to the Private Practitioners also. Professional Associations and Societies can also start subscription Libraries for the benefit of their members.

(vi) There is no facility for training in Medical Librarianship in the country. The National Medical Library should start the proposed Orientation course in Medical Librarianship without further delay. It is also desirable to include an optional paper on Medical Bibliography and terminology in the University Courses in Librarianship for those who wish to take up Medical Librarianship as their career.

(vii) A National Data Bank for Health & Medical Statistics must be created and if possible computerized system be introduced to store and retrieve the data. This could involve with profit those Organizations - Medical and non-medical - which are already working on their own.

(viii) A fast Reprography Service is an integral part of any modern information system. While the valuable services rendered by INSDOC and other Institutions are recognized and appreciated by all of us, we need to supplement this service by providing more and more of such facilities at the National Medical Library and Postgraduate Medical Institutes so as to cope with ever increasing demand. The charges for this wervice should be kept as low as possible, subsidized if necessary, so that a genuine request is not dropped for financial constraints.

(ix) Translation services are equally slow and expensive to deter the most aspiring searcher. The ISTA (Indian Scientific Translators Association) and the National Medical Library could jointly evolve a scheme to make the translations available to the users quickly and at reasonable rates.

(x) Users Surverys may be conducted at various levels to identify their actual requirements and improvements in the service could be effected accordingly.

(xi) INDEXING & ABSTRACTING SERVICES:

Apart from the Local documentation lists and current awareness service bulletins at Institutional Levels, there are two noticeable efforts in the country namely Indian Science Abstracts by INSDOC and Index to Indian Medical Periodicals by the National Medical Library. The Health Literature Topics of the WHO, Geneva and Bibliography on Reproduction and Family Planning by the Regional Documentation Centre of SEARO, WHO, New Delhi are other useful services available to the users.

Coverage of Indian Literature in five major indexing and Abstracting Services of the World - namely EM, IM, BA, CA & PA - is very limited.

Thus we need to reorganise our indexing and abstracting services in such a fashion that the Indian Literature is adequately covered and brought to the notice of potential users quite fast. Areas of priorities should be identified and SDI (Selective Dissemination of Information) service should be initiated to feed the workers in their areas with latest information on regular basis. This task can be allocated to the respective institutions such as the NICD for Communicable Diseases, NIN (National Institute of Nutrition) for Malnutrition, NIFP (for Reproduction and Family Planning). But care should be taken to avoid duplication of efforts at all levels. There is no point in duplicating the efforts already being made at National and International Level.

Index to Indian Medical Periodicals could be made a monthly publication instead of half-yearly as at present. Annual cumulation could be issued. The National Medical Library is also planning to issue from 1976 a monthly current Awareness Bulletin to provide information in selected areas.

Time factor is very important in supplying any information to its user. At present there is a great time lag in printing of the Index to Indian Medical Periodicals. Efforts are afoot to reduce that gap and bring out this valuable publication uptodate. There is a great need to computerize the index as it gives wide scope to store the information under various headings and sub-headings which is not possible in ordinary indexing.

(xii) UNION CATALOGUES:

Union Catalogues or Lists of Holdings of Libraries in any Region play a very important part in Library and Information Service. INSDOC & ICSSR have done a commendable Job in this field. But the union catalogue of Medical Periodicals in Indian Libraries is lagging behind its last edition having been published in 1963. It is high time that a new edition be issued without further delay. It must be a continuous project and should be kept uptodate by annual supplements. CCRIMH is also seized of the need for bringing out Union Catalogues of Publications in their field.

(xiii) A Directory of institutions and Centres operating in the field of Health and Medical Sciences with emphasis on information and Library services should be compiled and published as soon as possible by the ICMR/NML Collaboration.

All these pre-requisites call for vigorous and simultaneous action on all these fronts. Once this viable infrastructure is built up, further developments to establish a really efficient operative system will follow logically and smoothly. The NCST Plan for Science and Technology Information Service include the Health and Medical Sciences as well and therefore it is reasonable to expect that the Medical Library System would also benefit from it and utilize the additional resources thus made available to improve its services. "Collaborate or collapse" the slogan coined by Advani (1974) (4) very aptly describes the motto around which we must muster our efforts if we desire to achieve our cherished goal of placing right information at right time and place in the hands of our dear readers.

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PAPER D-6.

INFORMATION SYSTEM FOR AGRICULTURE SECTOR*

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Need for a Computerised Information System

1. The agricultural sector is the most important sector in India's economy as nearly 45 per cent of the GNP originates in this sector. Though it is a very traditional sector it has now become a sector in which technological progress in production techniques has become very rapid. More or less a continuous flow of new technology is coming out of the research and experimentation stations. For gstting the best results, information on this new technology and its implications for production decisions and general agricultural policy should be made available to the concerned people as soon as possible.

2. Very few countries have been able to manage and develop the agricultural sector satisfactorily. This is due to a number of reasons. Firstly, conventional economic theories of development and planning concentrate largely on the industrial sector. Not much thought is given by academic economists to developing techniques of planning and managing the agricultural sector.

3. Secondly, the agricultural sector has a very large number of producers each with his own production possibility which is affected by the soil types, irrigation availability, and knowledge of the available technology w.r.t. seeds, fertilizer, pesticides etc. Moreover different crops can be grown from the same land. Any satisfactory considerations of this variability requires analysis of vast amount of data.

4. Thirdly, in many developing countries as in India the bulk of agriculture is dependent on weather (monsoon), variations in which affect significantly the production of food grains. The monsoon does not seem to follow any predictable pattern - atleast not one which can be discerned from 50-100 years' data. It becomes necessary to resort to a more extensive analysis to bring into considerations effects of unpredictable monsoon in policy making.

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5. All these involve vast amount of data, and data which have to be up-dated frequently. A large computerized information system is a necessary prerequisite before any satisfactory analysis can be made to manage the agricultural sector in a country such as India.

6. A computerized system is vital for yet another set of reasons. The data required for a successful management of the sector are collected by many different organizations. For example, the data on climate, rain and moisture availability and need are collected by the meteorological department. The data on areas devoted to different crops are collected by the Ministry of Agriculture. The information on yield response of different crops to different availability of water is likely to be available with the Indian Council of Agricultural Research. But the irrigation systems are operated by th irrigation department. Most often this is done without the benefit of the data available with other organizations. Optimal irrigation releases can make significant difference i the agricultural production. In determining optimal irrigation releases, data on all the above are required. A large central computerised information system can provide the data from many sources to the various operating agencies. However, not only such data are required the data are required in time so that irrigation releases can be chang in response to changing cropping pattern and the unfolding behaviours of the monsoon. Such a responsive system can be made to work only in the context of a central computerised information system. At present in the operations of many irrigation systems the pattern of releases are based on cropping pattern which prevailed in the command area some years ago. This leads to grave inefficiencies in the use of irrigation water, as under the impact of new varieties cropping pattern change substantially from year to year.

7. Timely processing of large amount of data is also essential for improving the reliability of forecasts and hence policy which in real world has to be based on forecast of coming events.

8. For example this year it was predicted by the meteorological department that the monsoon will be delayed by two weeks. The various state governments were warned and asked to take corrective actions; either to release more water from irrigation reservoirs during the normal sowing period, or to be ready for a second planting or to sow a different variety which can be sown late in the season.

9. Even in the analysis of past data, where timelines may not be crucial, the need to bring all data at a common place accessible to all is great. Today we have vast amount of data, collected at enormous expenditure, lying unprocessed or partially processed. These data would become even more valuable when processed together with data collected by different organisations.

10. For example, the climatological data from meteorological department can be used along with the experimental data collected under various programmes of the Indian Council of Agricultural Research (ICAR) to estimate production functions with climatic factors as explanatory variables along with seed variety, fertilizer desages etc. Similarly the forecasts of agricultural production being attempted solely on climatological data by the meteorological department can be improved by using the yield production functions estimated from the various experiments.

11. As yet another example can be cited the question of evolving cropping patterns for arid zones. Based on climatological data one can build up the profile of expected soi moisture availability for a given zone. This information can be used along with the pro-

ction functions estimated from the ICAR experiments to select optimum cropping tterns for the zone.

. Both the Institute of Agricultural Research Statistics (IARS) and the India Meteo- logical Department (IMD) plan to get computer systems of their own. These systems, wever, will be fully employed in routine bulk data processing. It is thus necessary to tablish a higher order computer centre to integrate the data coming from these and her organisations for effectively aiding policy in the agricultural sector. In fact, ithout such a central computerised system and the analysis that is made possible by it, ll and effective use of the information generated by the IARS and IMD computer sys- rms would not be possible. An integrated dholistic view of agricultural planning would ecome possible only if such a system is established and made operational.

3. In fact, but for these computers and the small computers that are being planned y some state governments, it would be a near impossible task to build up the data base or a computerised information and management system. For then, the vast amount f data gathered by many primary agencies all over the country would not be available in nachine readable form. To make these data machine readable would be an impossible ask for a single organisation without unlimited resources.

4. The purpose of this report is to outline an up-to-date information system, and to show what can be done in this area with the help of such a system. We first identify the users of such a system and the objectives of Agricultural Policy and the decisions that various actors have to take in this sector. Next, we outline the various analytical frameworks relevant for taking these decisions. We will then survey the data sources, the channels and frequency of flow of data. Finally we will identify the various analyses that may be performed and decisions that may be taken better at different stages in the development of the system with available data and as data availability improves in the future. Finally we determine the computing power required for the system.

The Users of the Agricultural Information System

15. The Ministry of Agriculture is in the overall charge of Agricultural sector. However, the planning commission and the Ministry of Finance are involved in determining the size of its various programmes. The irrigation systems which were till recently managed by the Ministry of Irrigation and Power are now under the control of the Ministry of Agriculture. Under the constitution, agriculture is a state subject and the programmes are administered by the states governments. Important Policy decisions have to be taken in consultation with the state governments. For example : The fixing of the procurement support prices of agricultural commodities is a very important annual issue between the central government and the state governments.

16. The performance of agriculture affects the operations of other ministries of the Government. The public food distribution system and other relief measures have to be operated by the Ministry of Civil supplies. The extent of required imports of agricultural commodities affect foreign exchange budget and the national budget itself is affected by agricultural output.

17. The proposed agricultural information system would be used by these various ministries of the govt. of India. In the absence of such a system these decisions are, at present, based on the work of many inter-ministerial committees, and special study commissions. These groups have experts in the various areas and their judgement and expertise are brought to bear on the work of the committees. At this level the compu-

terised information system can very effectively help in quantitative decision making ar improve government policy in agriculture and areas affected by it.

18. On the other hand, the role that such a system can play at the farmer's level is also very large and by itself can justify such a system.

19. The farmers in India have tasted the fruits of the new technology of agriculture. They are now keen to adopt newer technologies almost as fast as they come out of the research stations. The extent to which farmers in India have adapted the new technolo can be seen in the table below which show the growth in use of fertilizers, and High Yielding Varieties (HYV).

Year	Area under HYV ('000 Hectares)		Fertilizers Distributed ('000 Tonns)
	Paddy	Wheat	$(N+P_2O_5+K_2O)$
1961-62			383
1962-63			478
1963-64			574
1964-65			653
1965-66			757
1966-67	888	541	1203
1967-68	1784	2958	1739
1968-69	2628	4793	1750
1969-70	4519	6100	1407
1970-71	5588	6480	1814
1971-72			2382
1972-73			2589
78-79 (Target)	16500	15000	8000

20. The numbers in the above table do not fully reflect farmers' willingness to adop new technology as there are substantial excess demands for fertilizers and improved seeds. Inspite of the recent doubling of fertilizer prices, there is still a black market of fertilizers and a premium of 100 per cent or more is demanded and paid.

21. A computerised system which can provide to the cultivators upto-date data in a form in which they can understand them and use them for taking rational decisions can at this stage prove to be of enormous value in solving India's food problem at minimal cost.

Objectives of Agricultural Policy

22. Stated very broadly the objective of agricultural policy is to assure adequate availability of agricultural products at reasonable stable prices. These prices should b high enough to be remunerative to the farmers and low enough to be acceptable to the consumers. To ensure stability in the context of uncertain weather, buffer stock opera tions have to be carried out. Since carrying buffer stock is expensive, an optimum policy has to be designed.

23. To provide adequate food for increasing population means to increase the productivity of land by promoting efficient practices and spreading knowledge of new possibilities. A whole range of options are available for this: Increase irrigation; increase use of fertilizers (chemical or organic) and pesticides; use different varieties of seeds; etc. With limited resources, these and other inputs must be optimally used and policies have to be devised to promote optimal uses.

24. Similarly, with limited water resources, a better management of available irrigation systems can substantially affect output. With a given quantity of irrigation water, which crop to irrigate, when to irrigate and with how much water, are important questions.

25. Apart from increasing the productivity of agriculture, a proper distribution of income generation in the agricultural sector is also desirable, Agricultural development should not lead to increasing inequality in the rural economy.

26. On the other hand, from the farmer's point of view, what crop to grow, what variety to select, how much inputs to put in, and when to sell the output, are the crucial questions. These are affected by his expectations of prices, his knowledge of technology, his reasources and the weather. In all these the farmer's main objective is to maximize his expected profits.

Issues in Agricultural Policy

27. Specifically the following decisions of agricultural policy are of importance:

(a) What crop and variety to sow in what areas?

(b) What should be the level of inpurts?

- Fertilizers
- Water
- Pesticides

(c) When should the inputs be applied?

(d) What other cultural practices are of importance?

- Timing
- Spacing, seed rate
- Soil treatment
- etc.

(e) When to sell the output?

(f) What type of animals to keep? How many of each type to keep?

(g) What to feed the animals?

(h) Should one go in for poultry keeping?
What should be the level of operation?

Decisions of Policy Makers

28. (a) Short Term Management

i) Estimate output to help in budget making.

ii) Estimate import needs and if necessary, provide for in foreign exchange budget.

iii) Determine advance action required in setting up public distribution system and fixing procurement targets.

iv) How much buffer stock to be carried over to next year?

v) Support prices to be announced.

vi) Prices of inputs such as fertilizers to be fixed.

vii) If necessary, inputs to be imported in time.

viii) Identify drought areas, to take relief measures in time.

ix) Determine policy for operating irrigation systems. What is the trade-off between irrigation and power generation? How much water to release? When, to which crop? Modification in the policy in the light of actual rainfall and inflows.

x) Detect in time incidence of pests and diseases so that control measures are taken in time.

(b) Medium Term Policy

i) Set targets of food availability to meet nutritional needs.

ii) Determine optimal cropping pattern for irrigated, rainfed and arid zones.

iii) Set targets for area under High Yielding Varieties.

iv) Increase potential for production through efficient use of fertilizers, irrigation etc.

v) Determine optimal allocation of fertilizers to different crops and agro-climatic zones.

vi) Determine optimal allocation of irrigation resources - to different crops.

vii) Determine priority areas for extension work.

(c) Long Term Policies

i) Set targets for irrigation development to insure against droughts.

ii) Set priorities for development of irrigation systems.

iii) Design irrigation system - what is the irrigation intensity? Storage capacity? How to mitigate effects of floods?

iv) Set targets for availability of fertilizer.

v) What should be the policy towards mechanisation? Is it land augmenting?

vi) Are there economies of scale in agriculture? What should be the size of a family's holding?

vii) Set research priorities - what new seeds to be developed for which crop and which zone and with what characteristics?

viii) What measures to take to preserve or improve general long term productivity of the system.

29. In order to take these decisions rationally research involving large amount of data processing is required in many areas. Some of the important areas are listed below:-

Useful Research for Decision Making

30 (a) Research in the technology of Agriculture and Animal Husbandry

i) Estimate production function of different crop varieties in different agro-climatic regions when independent variables are fertilizers, and/or water and climatic variations.

ii) Identify optimum techniques to irrigate, fertilize, sow etc. (Mechanisation or not?)

iii) Develop improved breed of animals. Maintain data bank of yield performances of progeny.

iv) Estimate production functions in animal husbandry. What feeds give best results for which breed?

(b) Ecological Considerations

i) What practices are good for soil-fertility maintenance?

ii) Bio-system studies to identify measures to preserve them for all users.

iii) Toxicity of chemicals - what pesticides .... and other agro-chemicals are acceptable.

iv) Toxic residues in food and their . . . . long term acceptability of chemicals.

(c) Climate and Weather Fluctuations

i) Can one forecast yields and output from climatological data?

ii) What is the expected date of 'arrival of monsoon in different parts of the country? Or what is the expected date of having enough moisture in the soil to begin sowing?

iii) What is the variability of rainfall and climate? What is the expected soil moisture availability over the year? What is a suitable crop cycle for the area?

iv) What is the relationship if any, between occurrence of diseases and pests and climate?

31. The above list is not exhaustive. Moreover many questions are overlapping and repetitive. Yet these have been separately listed to emphasise to a larger number of people the usefulness and need for an information system. People from different disciplines might view a problem from differing perspectives. None the less the basic theoretical framework for analysis can be common to most of these questions. We now turn to analytical frameworks appropriate for decision making in the agricultural sector.

32 Analytical Frameworks for Policy Making

(a) Analytical Framework for Pricing and Allocation

i) Farmers Decisions

We assume that :

farmers are rational and act in such a way as to maximize expected profits as perceived by them. Because of uncertainties of weather, effectiveness of new technology etc., and their different endowments of resources, different farmers behave differently. Yet within their constraints they maximize their profits.

33. For rational decisions at the farm level one needs to know the following:

(a) Technological production functions which relate expected yield for his soil and climate to the levels of various inputs.

(b) The prices and costs involved in using various inputs.

(c) The expected price of various produce.

34. Thus if proper input and output prices are fixed in advance a farmer can

(a) Allocate his land to different crops, and

(b) Decide on the levels of application of different inputs.

35. Formally, the farmer's decision problem is a non-linear programming problem as described below:

Maximize Profit,

$$\sum_{i=1}^{C}(P_i a_i y_i - c_i(a_i, y_i)$$

where P_i = price of output i

a_i = area devoted to crop i

y_i = yield of crop i (output per unit land)

c_i = cost of cultivating crop i on area a_i to obtain yield y_i

C = Number of crops which can be grown on that land (different variety to be considered as a different crop).

Subject to the constraints:

(a) Area constraint

$$\sum_{i=1}^{C} a_i \;—\; A$$

— Area devoted to crops cannot exceed total land area available with him, A

(b) Production Functions

$$y_i = y_i\,(N_i\,,\ P_i\,,\ K_i\,,\ w_i^1,\ w_{i,}^2 \ldots, w_i^J,\ R^1,\ R^2,\ R^J,$$

$$PET^1,\ PET^2, \ldots,\ PET^3,\ PEST_i\,)$$

Where N_i, P_i, K_i are fertilizers applied per unit area to crop i,

$PEST_i$ is the pesticide applied to crop i,

$w_i^1, w_i^2, \ldots, w_i^J$ are water applied in periods 1, 2, ... J of the i crop's life cycle.

$R^1, R^2, \ldots, R^J$ are the expected rainfalls over the periods, 1, 2, ..., J.

$PET^1, \ldots, PET^J$ are potential evapotranspiration over these periods.

(c) Cost Functions

$$c_i = c_i\,(a_i,\ y_i\,(\underline{\qquad\qquad})\,)$$

(d) Water availability constraints

$$\sum_{i=i}^{C} w_i^i \leq T^j \qquad j = 1, \ldots, J$$

Where T^j is the water available in period J from either tubewells or run off the river schemes, or planned irrigation releases.

(e) Fertilizer availability.

$$\sum_{i=1}^{C} F_i \leq \bar{F}$$

36. If fertilizers are scarce and a rationing system is followed, such constraints may be required. This also applies to other inputs.

37. In the above the policy variables which can be controlled by the central authority are prices of inputs and outputs and the irrigation releases planned. The technological information is embodied in the production function y_i's, and the cost function c_i's.

38. The production functions, y_i's, have to be estimated based on experimental data. For examples of these see Parikh et al (1974) and Minhas, Parikh and Srinivasan (1974).

39. Similarly the cost functions have to be estimated on the basis of farm management surveys. Cost is a function of the levels of various inputs. Either a detailed cost function can be introduced and levels of these inputs determined in the solution, or as a second best solution, the cost functions can be preprocessed to give a summary cost as a function of only area and desired yield as used above.

40. It should however be realized that these production and cost functions have to b estimated separately for each soil and climatic regions. The fineness of this classifi cation can be improved over time when more data become available.

41. The above is a simplified model which neglects the problems of uncertainty of yield performance, of rainfall, of climate and of prices of output. A dynamic programming model can be constructed to take into account these variabilities. However the data available for estimating the various frequency distribution are not likely to be available for some time. Thus the above framework or even a still simpler model car be used in the early stages.

Decisions of Policy Makers

How such an analytical framework can be used to take important decisions in th management of the agricultural sector is described in Minhas's (1969) 'Growth with Stability'. Briefly his scheme is as follows:

(a) Determine normatively a requirement vector of Agricultural products.

(b) Fix a set of input and output prices.

(c) Solve the above model for all the different agroclimatic zones.

(d) Compare the resulting output with the normatively determined requirement

(e) Adjust prices and iterate through steps 2 and 5 till a consistent solution is obtained. This gives a set of output and input prices which produces the desired output.

The same basic model can be modified to determine 'optimal' allocation of scarce input such as fertilizers. As an example see Parikh et al (1974). It can also be used to project agricultural potentials for a distant future to identify the need and importance o various technical changes (see Parikh (1973)).

Analytical Framework for Water Management

In order to study the question of economically optimal use of water, we need to know the responses to different quantities of water used by the crop throughout its grow cycle. For instance, consider a large reservoir system. The problems of scheduling of the operations of the system include decisions on timing of water releases and the allocation of water among crops. The later decision is also relevant for the operation of tubewells or run of the river irrigation systems. Unless one has the knowledge of th marginal productivity of water allocated to each crop at different stages of its growth, one cannot arrive at an optimal set of decisions. This knowledge is also required in determining the extent of the command area of an irrigation system. A production function for each crop, in which yield is related to dated inputs of water will provide such knowledge.

(a) Suppose the reservoir has a given amount of water per hectare, W, Assume also that only one crop is grown. We want to maximise the production

$$Y = Y(W^1, W^2, \ldots, W^J)$$

Where Y is yi eld per hectare, and

$W^1, W^2, \ldots, W^J$ are water releases in the 1st, 2nd,... Jth period:

Subject to the constraint that

$$W^1 + W^2 + \ldots + W^J \leq W$$

The conditions for optimality are

$$\frac{Y}{W^1} = \frac{Y}{W^2} = \ldots = \frac{Y}{W^J}$$

In order to solve this problem we need to know the production function Y. On how to estimate Y are Minhas, Parikh and Srinivasan (1974).

(b) Suppose we have a limited amount of water available in period j, I^J, and that crops 1, 2, ..., C are grown in areas $a_1, a_2, \ldots, a_C$.

We want to maximize value of output:

$$V = \sum_{i=1}^{C} P_i \cdot a_1 \cdot y_i (W_i^1, W_i^2, \ldots, W_{i)}^J$$

Subject to

$$\sum_{i=1}^{C} W_i^j a_i \leq I^j \qquad j = 1, \ldots, J$$

The condition for optimal allocation of water across crops and over time are as follows:

$$P_1 \frac{Y_1}{W_1^j} = P_2 \frac{Y_2}{W^j} = P_c \frac{Y_c}{W^j} \qquad j = 1, 2, \ldots J$$

Again knowledge of the production function Y_i is essential.

(c) A problem which is a combination of the problems (a) and (b) above. Though the algebra gets involved the essential approach is the same. Once again knowledge of the production function Y_i is essential.

(d) Consider the problem where the water in the reservoir is W_j and inflows of the remaining seasons are $I^1, I^2, \ldots, I^J$ with their probability distributions $p^1(I^1), p^2(I^2)$ .... given. The cropping pattern in the command area is $a_1, a_2, \ldots a_C$ (area devoted to crops 1, 2, ... C). Also the water releases from the reservoir generate power and the variations in the requirement of power over the year do not in general coincide with the variations in the need for irrigation releases. Thus, to some extent more irrigation means less power and vice-versa. In scheduling the operation of such a multipurpose system it is necessary to decide:

i) schedule of irrigation releases and power generation, and

ii) the yearend dead storage level.

For a detailed treatment of this set of problems and a case study of the Bhakra System see Minhas et al (1972).

(e) In the above problems we have neglected the essential stochastic nature of moisture availability and requirements. A dynamic programming framework is required to satisfactorily take these into account. We now describe such a model.

Suppose: We have a reservoir with water RW^i in period i. The inflows are I^i with probability distributions $p^i(I^i)$. The PET's are PET^i with probability distribution $p^i(PET^i)$. The areas devoted to different crops are

$a_1, a_2, \ldots, a_c \ldots a_C$ and their yield responses are $Y_c(AET^i/PET^i)$
Soil moisture levels are SM_c^i
State Variables are the soil moistures in different plots, $SM_1^i, \ldots SM_C^i$ crop yield indexes to reflect history till now, $YC_1^i \ldots YC_C^i$, and water in reservoir, RW^i.
Policy Variables are $W_1^i, \ldots, W_c^i$ the irrigation water releases for such crop in period i.

The value at the beginning of period i of all standing crops reservoir level and soil moistures is given by a function V^i.

$$V^i (SM_1^i \ldots SM_C^i, \; VC_1^i \ldots VC_1^i \ldots VC_C^i, RW^i)$$

$$= \underset{W_1^i \ldots W_C^i}{\text{Max}} \quad E \sum_{c=1}^{C} \quad (V_c^i (VC_c^{i\ max}, \; AET_c^i (U_c^i) + V^{i+1}(\qquad)\text{.}$$

Where E is the expectation operator and V_c^i is the gains function in the value of crop c due to irrigation operations in period i. The various relationships are as follows:

(a) $SM_c^{i+1} = SM_c^i - PET^i + E(R_c^i) + W_c^i$.

(b) $AET_c^i = f_c\ (SM_c^i, PET^i)$

(c) $YC_c^i = E\ Y_c\ (AET_c^i/PET^i)$.

where $AET_c^i \ldots AET_c^n$ are stochastic variables and

$AET_c^1 \ldots AET_c^{i-1}$ given.

(d) $W^{i+1} = RW^i + E(I_c^i) - \sum_{c=1}^{C} w_c^i - PET^i \cdot A(RW^i)$

where $A(RW^i)$ is the area of reservoir as a function of water in reservoir.

This is a formidable problem and even then it is not the most general one as the areas devoted to different crops are not considered policy variables as in fact, they are. To actually carry out computation for such a model requires collection and preprocessing of large amount of data. However, one need not start with such a sup r model. Simplified partial models such as those described in (1) to (4) above can be used meanwhile. For description of stochastic partial models of water management see the series of articles by Dudley et al (1971 ab., 1972 ab.) and the article by Hall and Butcher (1968). In fact in the first stage one would use such partial models, and as more data become available, let the system evolve and grow to the model described above or beyond that to more complex ones such as would determine area allocations internally.

*Data Requirement and Availability**

As is obvious large amount of data are required. These may be grouped under the following broad headings:

(a) Various Agronomic Experiments
(b) Simple Fertilizer Trials
(c) Potential Evapotranspiration
(d) Rainfall data by stations
(e) Irrigation Availability by schemes-canals and command area details
(f) River inflow data
(g) Actual area, yield, production
(h) Soil type and characteristics
(i) Residual soil fertility
(j) Water tables.

45. All these data are required for as long a time series as possible for building up expectation functions and frequency distributions.

46. Vast amount of data are collected in India. Moreover data for many years are available. We now examine in detail the present availability of data and the form in which these are available as well as the volume and frequency of collection. We will also consider the limitations of these data.

Crop Area Statistics

47. Practically 93 per cent of the country's geographical area, excepting for the hilly and inaccessible areas and the occupied area of Jammu and Kashmir, are covered by some reporting agency or other. The data on area devoted to various crops are collected every season by complete ennumeration of all plots in every village excepting for the states of West Bengal, Orissa and Kerala where data are collected on the basis of a random sample.

48. These data are available for more than last 20 years. Districtwise data are published and can easily be put on punched cards, (one year's data would require about 1000 cards). Villagewise data are available at the Tehsil headquarters and Tehsilwise data are available at the district headquarters. 1/ These may also be easily obtained and

* This section is prepared with the help of the member of the project team, and especially with the help of Dr. Yayathi.

1/ There are roughly 350 districts and 3500 tehsils in the country.

transferred on the punched cards (four cards per village per year). Plotwise data are available at the village level and would be voluminous. If, and when, these data are computerized they can provide scope for a variety of studies at micro-level which would be extremely useful for their implications for welfare oriented policies.

49. The data on area under different crops for the current season are also available soon after sowing is completed, under the Timely Reporting System (TRS) on a sample basis (one out of every five villages). Thus the data on area can be kept almost upto-date making it possible to analyse issues of short term policy.

50. Data on area and production of plantation crops like coffee, tea, rubber, cardamom etc. are available in very great detail in the records of the Boards which control the cultivation of these crops. The data recorded annually, are available for individual cultivators.

Yield and Production Statistics

51. The estimates of yield and production are based on crop cutting experiments. At present about 1,50,000 crop cutting experiments are conducted annually on food and non-food crops. Along with the data on yield auxiliary information is also collected in these experiments. These data on yields can be readily computerized and the system be made upto-date. Data from past crop cutting experiments are available for almost 20 years. One year's data would require 0.6 million cards.

In addition, as a part of its study on impact of HYVs, the IARS conducts around 2,0,000 crop cutting experiments a year over 80 selected districts. In this programme information on other cultural practices are also collected. It has been going on for the last four years and these data are already on nearly 1 million punched cards.

Soil Resources Data

52. The All-India soil survey and various coordinated schemes for studies on soil salinity, irrigation, drainage, soil science and water management collect large volume of information on soil data. A large number of soil testing centres distributed throughout the country analyse more than 11,00,000 soil samples each year under the soil test crop response studies. About 2,00,000 soil samples are collected each year under the All-India Soil Survey Scheme.

Improved Seeds, Use of Fertilizers and Other Improved Practices

53. Data collected in periodic sample surveys do provide some information on these aspects. However, more reliable and comprehensive schemes to collect these data have recently been taken up. In addition to the IARS Scheme on Impact of HYVs mentioned above, the National Sample Survey Organisation (NSSO) canvasses 30000 fields a year as a part of the Scheme to Improve Agricultural Statistics (IAS) Scheme). Other surveys are also carried out by the Ministry of Agriculture and organisations such as Fertilizer Association of India.

Input-Output Relationships

54. The crop cutting surveys provide estimates of yields per unit area in irrigated and unirrigated land in different states. A large volume of data relevant to the estimation of input output relations is generated by the various all India crop improvement

programmes of the Indian Council of Agricultural Research (ICAR). The simple fertilizer trials conducted as part of national demonstration programme have accumulated a vast body of information on yield responses to fertilizers. On the basis of these, yardsticks of response of major crops to irrigation and fertilizers in irrigated and unirrigated conditions have been evolved. In general these yardsticks are related to the effect of particular inputs on yields. However, in the case of high yielding varieties a composite yardstick intended to reflect the additional production from the application of the recommended package of inputs and management practices have been estimated.

55. Specifically the following major IARI and ICAR projects provide vast amount of data, most of which are available on punched cards.

(a) Coordinated Scheme on Micronutrients of Soils:

Objectives:

(i) Study of micronutrient deficiency, symptoms and their uptake by indicator crops most sensitive to these nutrients.

(ii) Establishment of critical limits for the micronutrients in important crops.

(iii) Relationship and determination of micronutrient needs of crop requiring high dose of fertilizers.

(iv) Delineation of the areas of micronutrient deficiency.

(v) Response of added micronutrients on the representative soil of the region and their relationship to micronutrient content of plant and the available micronutrient content of soils.

Locations: 8; Period: 1.4.69 to 31.3.74
(data available from 1.4.67 at some centres)

(b) Coordinated Scheme on Microbiological decompositions of Organic matters in Indian Soils under different climatic conditions:

Objectives:

To investigate the types of micro-organisms associated in the decomposition of organic matter and course of decomposition in Indian soils, the influence of organic matter on soil structure and crop growth and yield.

Locations: 6; Period: 14.8.67 to 31.3.74 5 year project.

(c) Coordinated Agronomic Experiments Scheme (Model Agronomic Experiments Scheme and Simple Fertilizer Trials Scheme):

Objectives: For IIIrd Plan 1967-68 to 1972-73:

(i) To obtain scientific information of the individual aggregate and cumulative effects of a number of growth factors (fertilizers, variety, cultural practices etc.)

(ii) To study the relative efficiency of nitrophosphates, ground rock phosphate and other phosphate fertilizers as compared to superphosphate or ammonium phosphate and also response of acid soils to liming.

(iii) To determine maximum intensity of cropping possible in different agro-climatic regions.

(iv) To obtain any information on any aspect of dealing with fertilizer use as might be required by ICAR.

Locations: 75

Objectives: For IVth Plan:

(i) To work out the response surface for N, P, K, for different crops in different agro-climatic regions of the country with emphasis on newly introduced high yielding varieties.

(ii) To work out the relative efficiency of different phosphate fertilizers (of varying citrate and water solubilities) for legumes and their residual effect on cereal crops.

Model Agronomic Experiments: at 46 Centres, start of project different at different centres the earliest being from 1.5.56.

Simple Fertilizer Trials: High yielding varieties at 30 locations, Rainfall at 20 locations.

(d) All India Coordinated Research Project on Soyabeans:

Objectives:

To evolve high yielding varieties of soyabean suitable for different agro-climatic conditions.

Locations: 11; Period: April 1967 to 31 March 1971 extended to 31 March 1974.

(e) All India Coordinated Research Project on Cotton:

Objectives:

To intensify the research work for increasing the average yield in cotton growing tracts and fibre quality of indigenous varieties.

Locations: 29, Period: April 1, 1967 to 31 March 1971 and extended to 31 March 1974.

(f) Coordinated Scheme on Soil test Crop response Correlation:

Objectives:

To conduct research on the fundamental and applied aspects of soil test crop response correlations on district and agro-climatic basis with a view to improve the prediction of soil tests.

Locations: 13, Period: 1.4.67 to 31.3.74 five year project.

(g) Coordinated Scheme for Studies on Measurement Evaluation and Improvement in soil structure-IV Plan Scheme:

Objectives:

To standardise certain basic techniques for evaluating soil structure with a view to work out a simple value index of soil structure that correlates best with crop yield.

Locations: 9; Period 1.4.69 to 31.3.74 five year scheme.

In addition, there are a large number of other projects conducted by the various agricultural universities. These are reported and published in the National Index of Agricultural Field Experiments. Data from past experiments can be computerized with modest effort, and a scheme can be organized to get data from new experiments for the information system.

Cost of Cultivation:

56. The Farm Management Surveys sponsored since 1954-55 by Department of Economics and Statistics of the Ministry of Agriculture give the cost of production of field crops on per hectare and per unit of production basis. The surveys also provide data on the extent of employment and unemployment of family labour and availability of capital equipment on farms. These surveys in the past have covered only a limited part of the country and were not frequent. However, a programme to cover the country regularly is started and data on sample basis are being collected in different states on a continuing basis. More than 7,000 farms are covered every year and data on daily expenditures and inputs are collected. Monthly summaries of these data are put on punched cards and one year's data require nearly 5 million cards.

In addition, cost data are also available from many surveys conducted by Institute of Agricultural Research Statistics as also from surveys of National Sample Survey.

The Farm Management Survey data for the last three years are already on computer cards and the future data are also to be processed on a computer.

Prices of Output:

57. Weekly data on market arrivals, trade stocks, sales, prices and market situation are being collected from about 1,000 markets in all the States. Though, the total number of markets as well the distributions of their number among crops has varied over time all the important markets are covered. Retail price data on about 72 commodities from 100 centres in the country are also collected, and from about 70 markets data on trader's margins are collected. For eight weeks around harvest times data from all districts are collected for farm harvest prices.

Distribution of Land holdings, tenancy and Income:

58. The agricultural census of 1971 carried out by the Ministry of Agriculture has collected information on a variety of items such as size, tenancy rights etc. for nearly

70 million operational holdings in the country. The data for many states are already available on magnetic tapes. The total number of cards for this census data would be around 70 million cards.

59. It is also proposed to regularly up date these data through sample surveys in the future.

60. The data on inequalities in income, consumption and savings and pattern of employment and wages are available from NSS and Farm Management Surveys.

Animal Husbandry

61. Livestock census have been carried out in India every five years since 1920. Data on size and composition of livestock as well as age distribution of livestock are collected. Though village level data are available at the tehsils, only tehsilwise data are published.

62. Data on output of milk, eggs and other animal products have been estimated so far only on ad-hoc basis. However, systematic sample surveys are now conducted every year to collect these data regularly. The animal husbandry division of the Directorate of Economic and Statistics (DES) of the Ministry of Agriculture collects data on livestock products. The IARS also conducts livestock products survey in selected states. These data are transfered onto 0.25 million punched cards per year.

63. Research in animal husbandry is reported in the National Index of Animal Experiments. Input output relationships for livestock operations can be estimated from these experiments. Data on economies of cattle and buffalo keeping and daily operations are collected from selected districts by the IARS. Under the dairy impact survey data are collected on various aspects of the economy of the selected districts. These surveys generate 0.5 million cards a year.

Machinery Implements and Investments:

64. In the livestock census, data are also collected in respect of ploughs, carts, sugarcane crushers, oil engines used in irrigation, electric pumps, persian wheels, tractors and ghanis.

65. The Rural Credit Surveys of Reserve Bank of India provide data for estimating gross and net investment and the sources of finance. Comprehensive data on annual basis are available for credit given by the institutional credit channels.

Fishery:

66. Central Marine Fisheries Research Institute collects data on catch of marine fish since 1950 on a sampling basis. Varietywise catch, type of equipment, duration of fishing etc. are reported.

67. No systematic data are available for catch of inland fishing.

Forestry:

68. Data on area and type of forests are collected by the state Forest Departments. Data are available on volume of standing timber and firewood as well as out-turn of these, as also of other minor forest products.

69. Though the data for forests under Forest Departments are fairly reliable, data for forests controlled by corporate bodies, civil authorities, and private owners are not complete.

Climatological data:

70. The India Meteorelogical Department will celeberate its centenary next year. Vast amount of data have been collected over the past hundred years. The IMD maintains an extensive network of observatories to record systematic and regular observations relating to weather elements, like rainfall, pressure, temperature, wind etc. to detect and track storms and cyclones; to monitor cloud pictures and other data from satellites and to record earthquakes. The observational organisation as on 1.4.1974 consists of, among others (for complete details, refer to the publications, Observational Organisation, India Meteorological Department, Government of India, New Delhi), the following:-

Type of Observatory	Number	Elements Observed	Frequency of observation
Surface observatory	504	Some or all of the elements atmospheric pressure, air temperature maximum and minimum temperature, relative humidity wind speed and direction, rainfall, evaporation, sunshine and occurence of weather phenomena according to the class of the observatory.	One to eight observations a day according to the class of the observatory.
Agrimet observatory	123	Meteorological and biological, Meteorological elements observed include rainfall, air temperature, humidity, soil temperature and moisutre, wind speed and direction, evaporation and occurrence of weather phenomena like thunder-storm hail storm, frost, etc.	Twice a day.
Hydromet observatory	320	Some or all the elements rainfall, temperature, humidity, wind speed and direction, evaporation and sunshine.	One or more observations a day.
Raingauge	4000	Rainfall.	Once a day.

There are 47 surface observatories for which data for 100 years or more are available.

The data from 1945 onwards are on 25 million punched cards. Annual addition of data is at present 3 million punched cards. In addition IMD has a special division on agro-meteorology, which has collected data under following programmes:

(a) All India Co-ordinated Crop Weather Scheme: Data on crop stage and growth along with weather parameters are collected at 50 centres on experimental farms. These data are available for 5 to 30 years for different crops. The data are on 1 million cards.

(b) Soil Moisture Evapotranspiration Studies: Lysimetric observations are being made at a number of agromet stations, and the programme is to set up nearly 200 such stations with 2 to 3 lysimeters each.

Irrigation:

71. Data on various irrigation projects are available with the Central Water and Power Commission. These include complete details of reservoirs, canal network, culturable and command areas. Data are also available on the cropping patterns, soil type etc. for the command area.

Water Availability in Rivers:

72. Data from 1003 gauges and 1862 gauge discharge sites are available for many years. The gauges measure water levels, three times a day whereas the gauge discharge sites provide discharge/day. These data are being transferred on computer cards and will take 1.5 million cards.

Ground Water Availability:

73. The ground water board as well as the various state tubewells organization have data on ground water potential and its exploitation. These data could easily be computerised.

Summary on Data Availability:

74. The above is a brief description of available data. The details of sample frames etc. are described by Saluja (1972). Comments on the limitations of these data are given by T. N. Srinivasan and A. Vaidyanathan (1972). The major limitation of these data arise from the incomplete coverage of the country. Nonetheless, complete coverage of the country is not always required and the data are capable of providing very useful guidance in policy making. The data availability is summarised in Table - 1.

75. From this review of data, it is quite clear that enough data are available in machine processable forms so that an information system can be made to function productively within a short time. It would be reasonable to expect analyses which will help in decision making within 6 to 12 months after the project is undertaken. Some of the data gaps may take some years to fill. Till then the analyses that may be carried out can only be less sophisticated. However, these analyses would still be better than what are possible without such an information system, and would lead to substantial improvements in policy decisions.

Outline of the System:

76. We can now outline an information system which will help in decision making in a series of policy issues. Our attempt would be to outline a system which starts producing results as soon as some data are in and not a system which has to wait to produce results till all the data are in.

(a) The Data Storage:

The Data available are enormous and not all of them are required in raw form for analysis. Preprocessing will certainly be done and only processed data will be stored in files of high accessibility.

The data organisation for many files would be on the basis of agro-climatic zones/districts/Tehsils/Villages in progressive stages. For each of these regions the data stored in the processed form is described below:

Data stored by agro-climatic zones

Agricultural data

1. Irrigated/Rainfed Area under crops
2. Soil Resources, Type, Characteristics, Fertility status
3. HYV spread, area under different crops
4. Pesticide etc., use, intensity, extent
5. Fertilisers, Use, intensity and extent
6. Frequency Distribution of yields of different crops, varieties for irrigated and rainfed cultivations
7. Fertiliser dosages applied in past
8. Residual fertility in soil
9. Yield response functions to fertilisers, pesticides etc. for crop varieties for irrigated, rainfed cultivation
10. Expected output cost functions for different crop varieties and input levels
11. Price forecast functions
12. Expected prices. Frequency distributions of prices over the years
13. Distribution of size of holdings irrigation and soil type
14. Distribution of income, consumption, savings, employment, unemployment by size class of holdings.
15. Distribution of households by size class of holdings of implements machinery, engines/pumps.
16. Distributions of livestock
17. Milk yield and Egg out turn function for different feeds of different breeds
18. Growth feed functions for different feeds of different breeds

Climatological Data

19. Frequency distribution of rainfall by weeks and conditional prediction formulae
20. Frequency distribution of PET by weeks and conditional prediction formulae
21. Frequency distribution of soil moisture availability be weeks
22. Yi ld response functions to dated inputs of water for different varieties in different soils

23. Acreage prediction regressions based on climatic data
24. Yield prediction formulae based on climatic data
25. Pest incidence prediction formulae based on climatic data
26. Ground water exploitation and potential and recharge frequency distributions.

In addition, the following sets of files will be grouped by irrigation projects:-

27. a) Physical Details of project
    b) Command area by different agro climatic zones
    c) All the data for the various zones of command area.

28. Frequency distributions of inflows at the reservoirs/wair by weeks and conditional prediction formulae.

(b) Use of Data:

These data files are required for specific purposes of analyses for decision making. Additional data files should be added whenever they are required in any decision making problem. One should avoid the temptation to store data for their own sake or for some possible future use. This may not only clutter up the system but would waste respurces in data transcription at the cost of data analyses.

Some examples of flow charts showing where these data files are used in decision making are given in figures 1 to 9. The general flow chart in figure 10 shows the flow and use of data in the system.

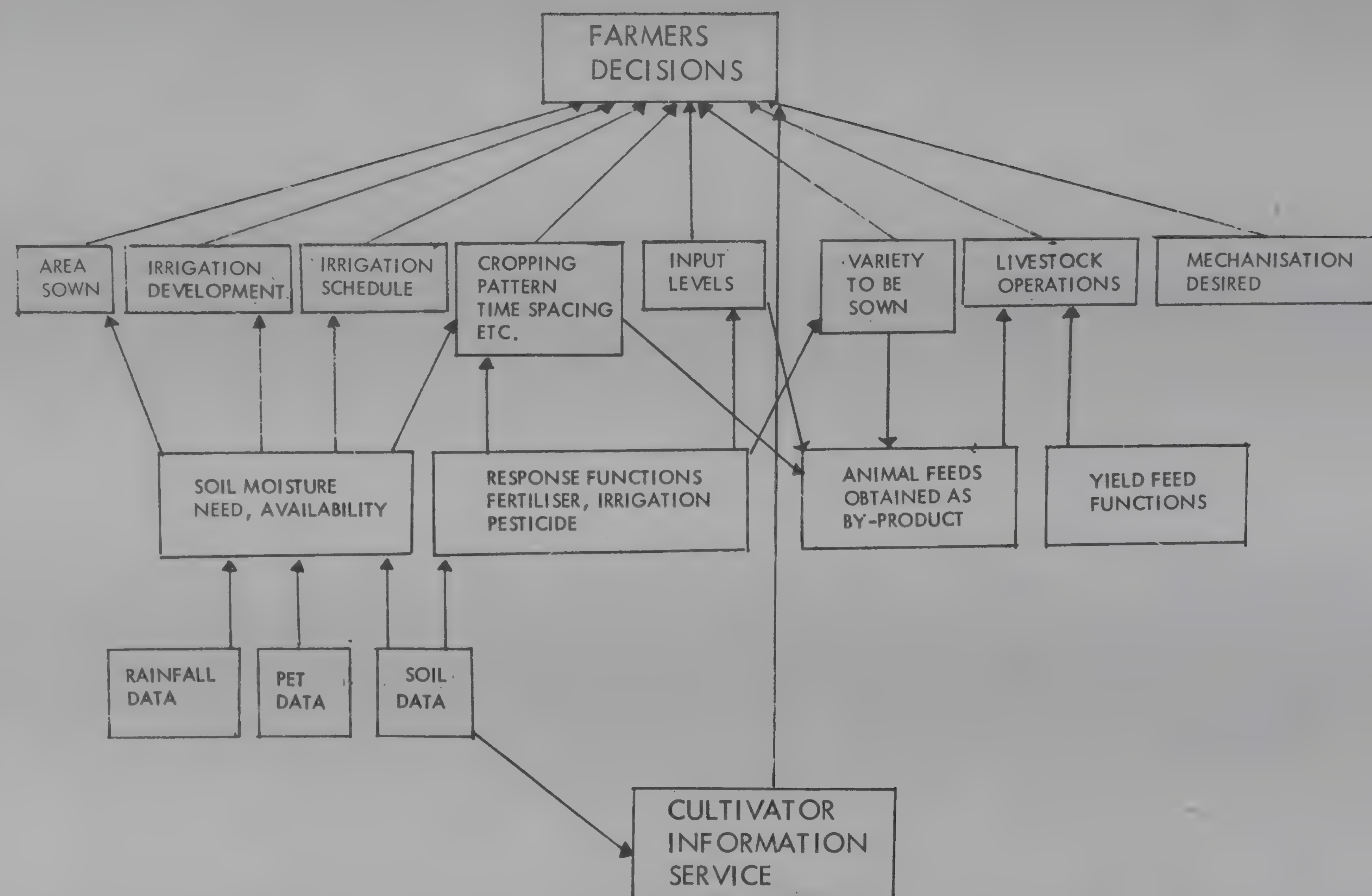


Figure 1. Farmers Decisions.

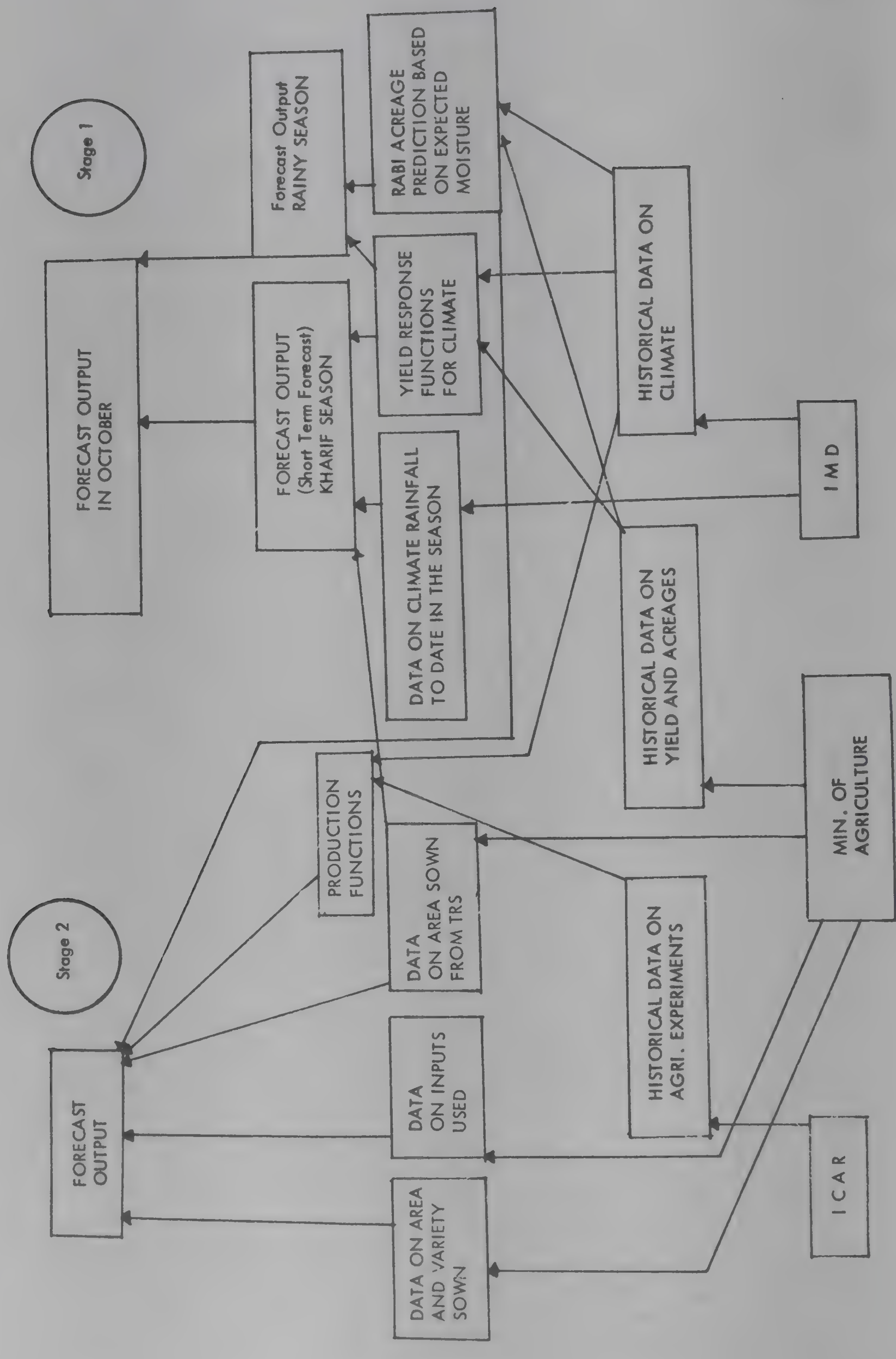


Figure 2. Forecast Output.

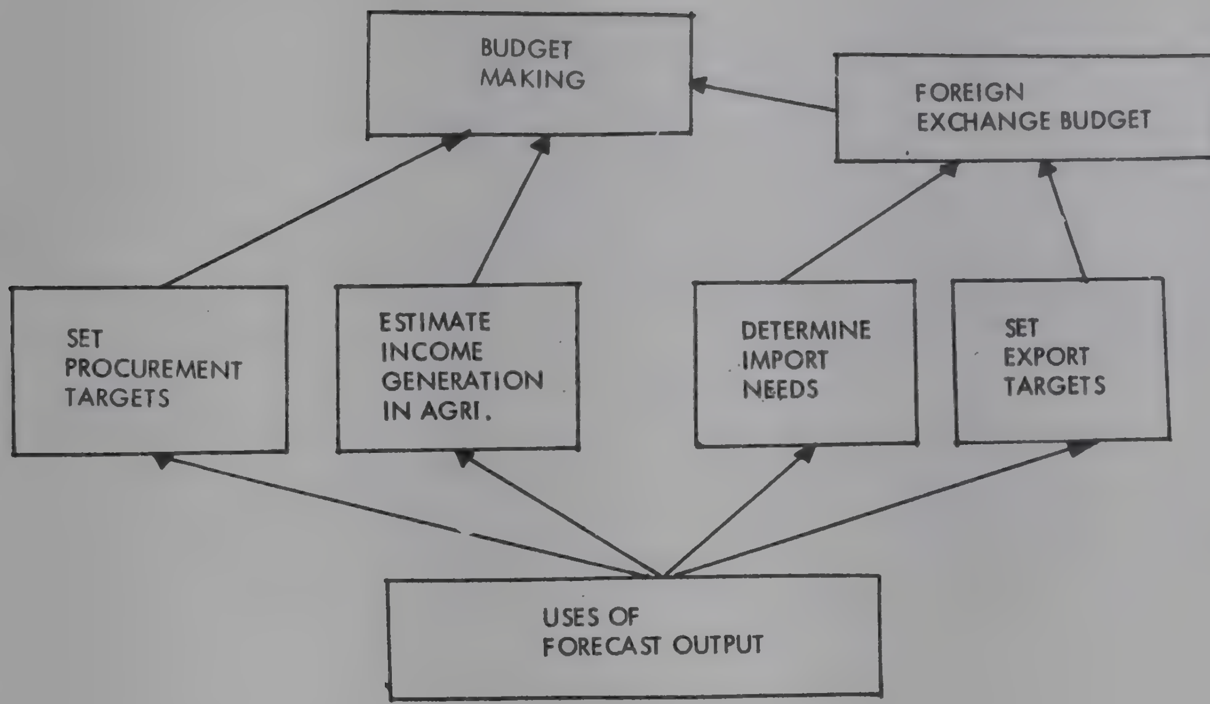


Figure 3. Uses of Forecast Output.

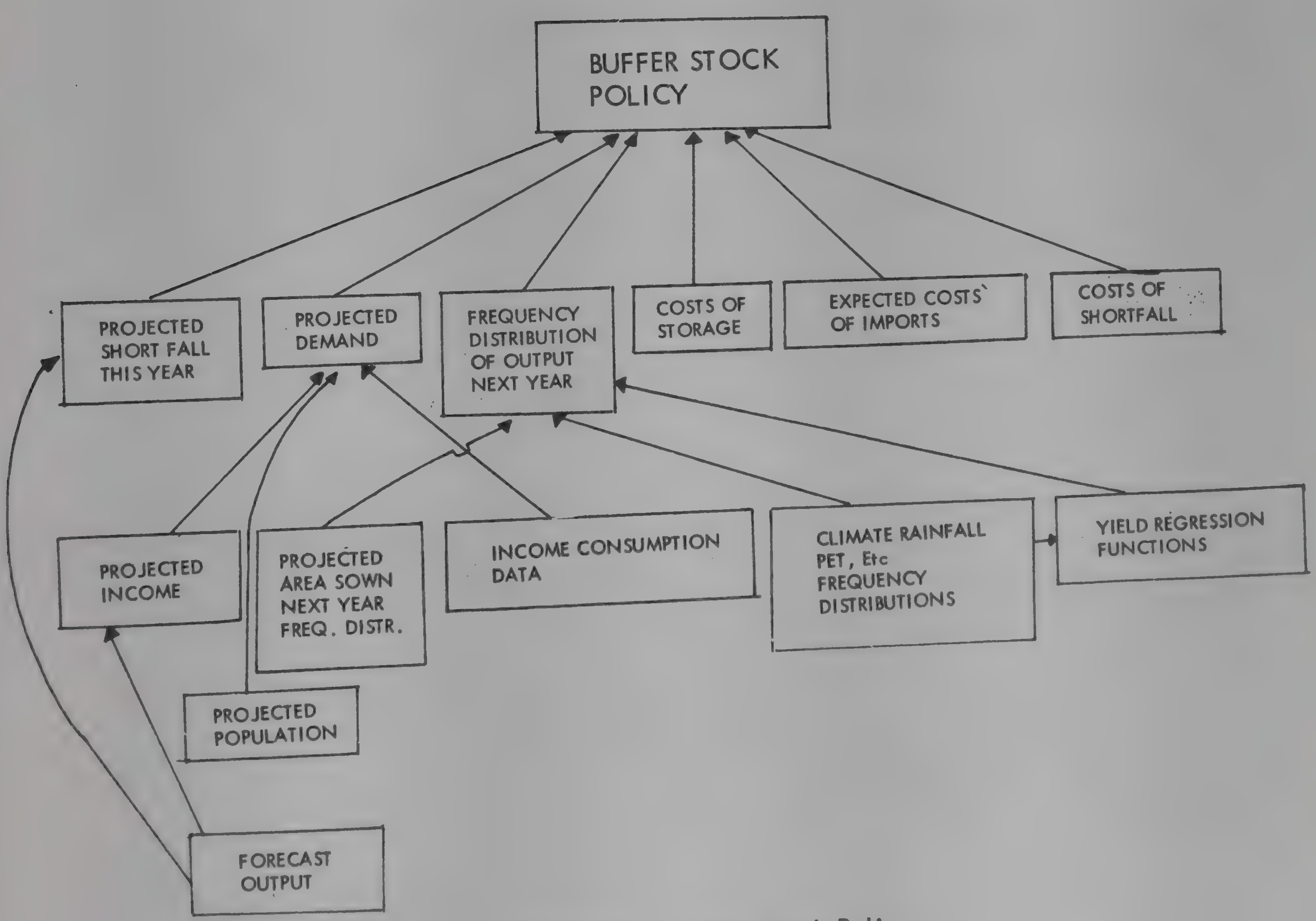


Figure 4. Buffer Stock Policy

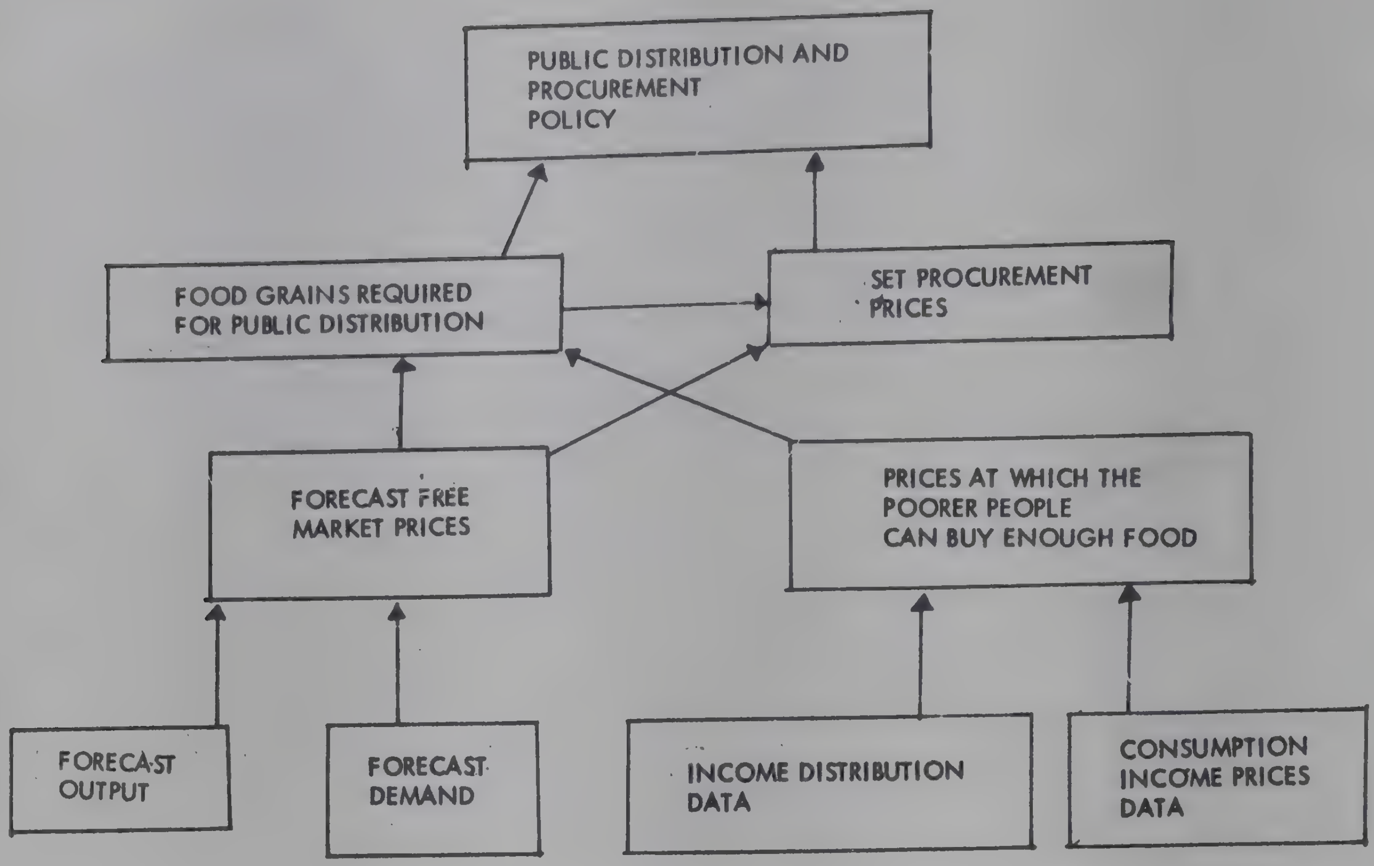


Figure 5. Public Distribution And Procurement Policy

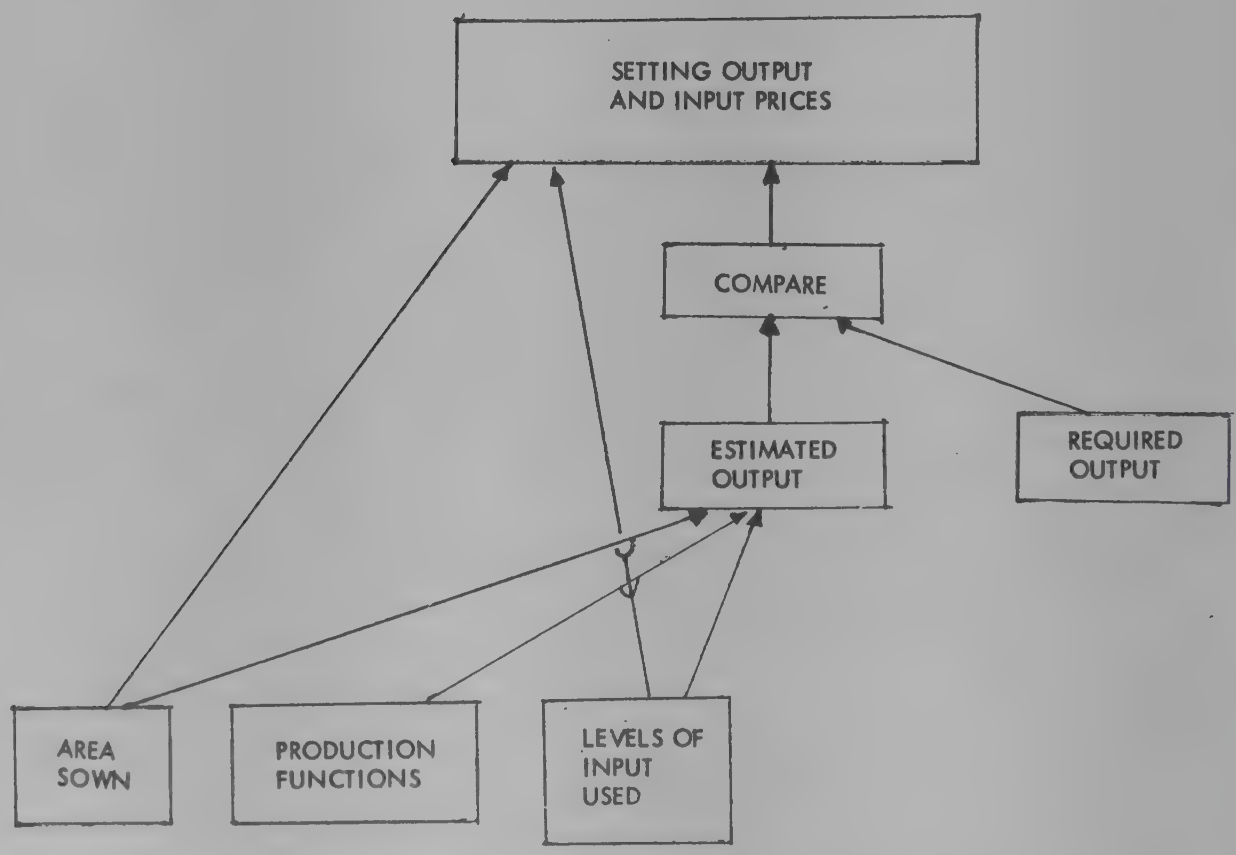


Figure 6. SETTING OUTPUT & INPUT PRICES

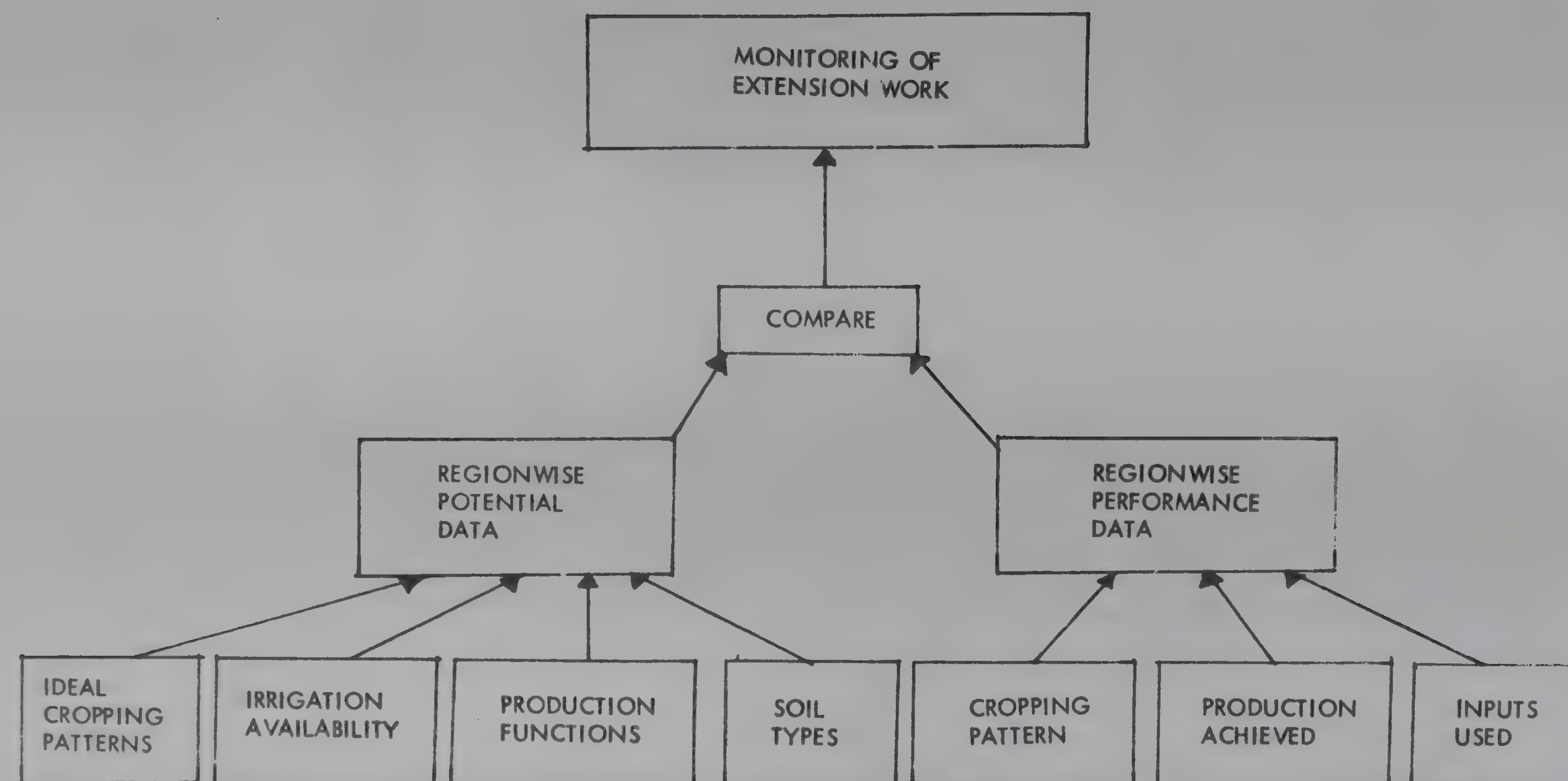


Figure 7. Monitoring Extension Work.

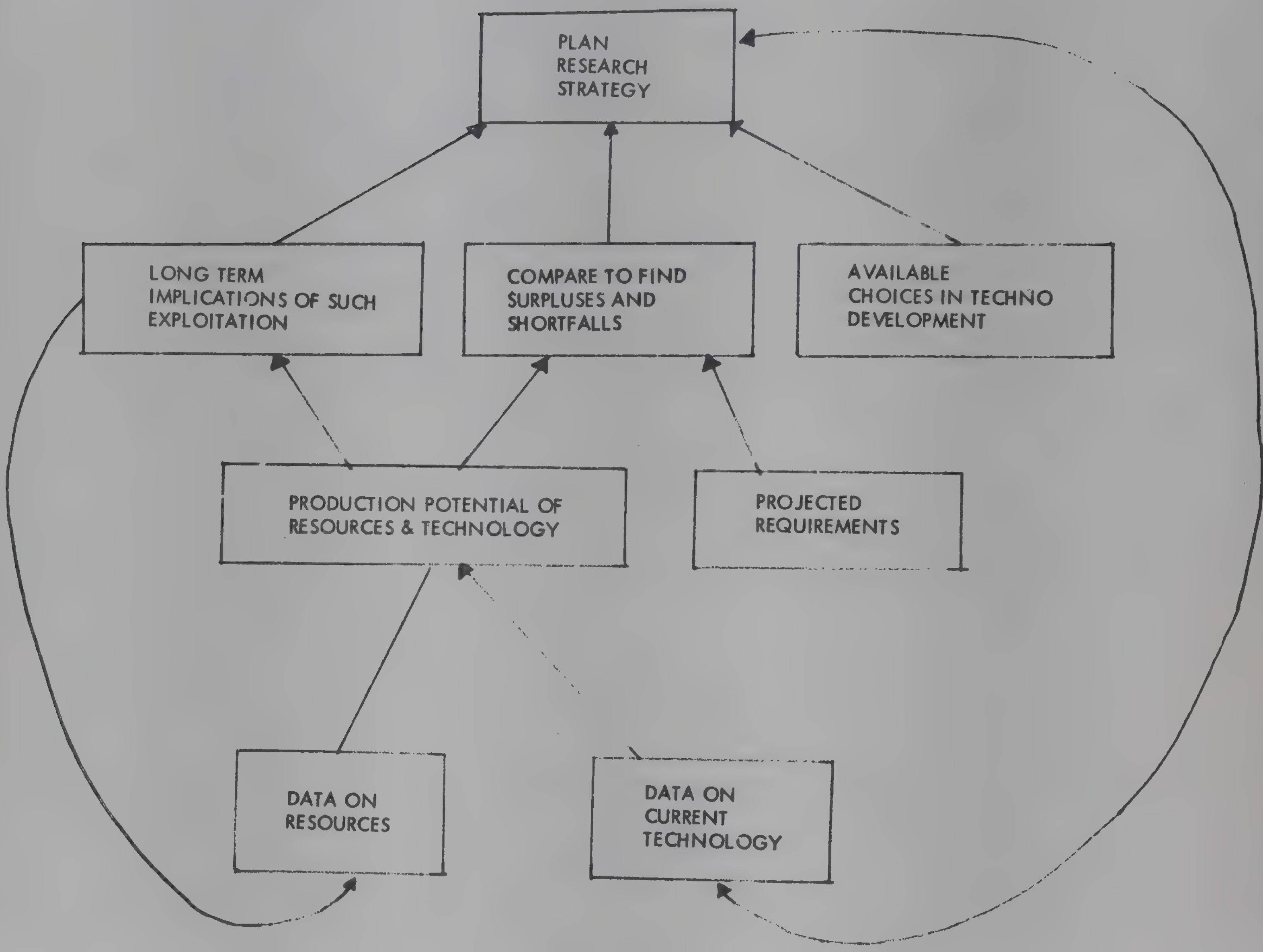


Figure 8. Planning Research Strategy

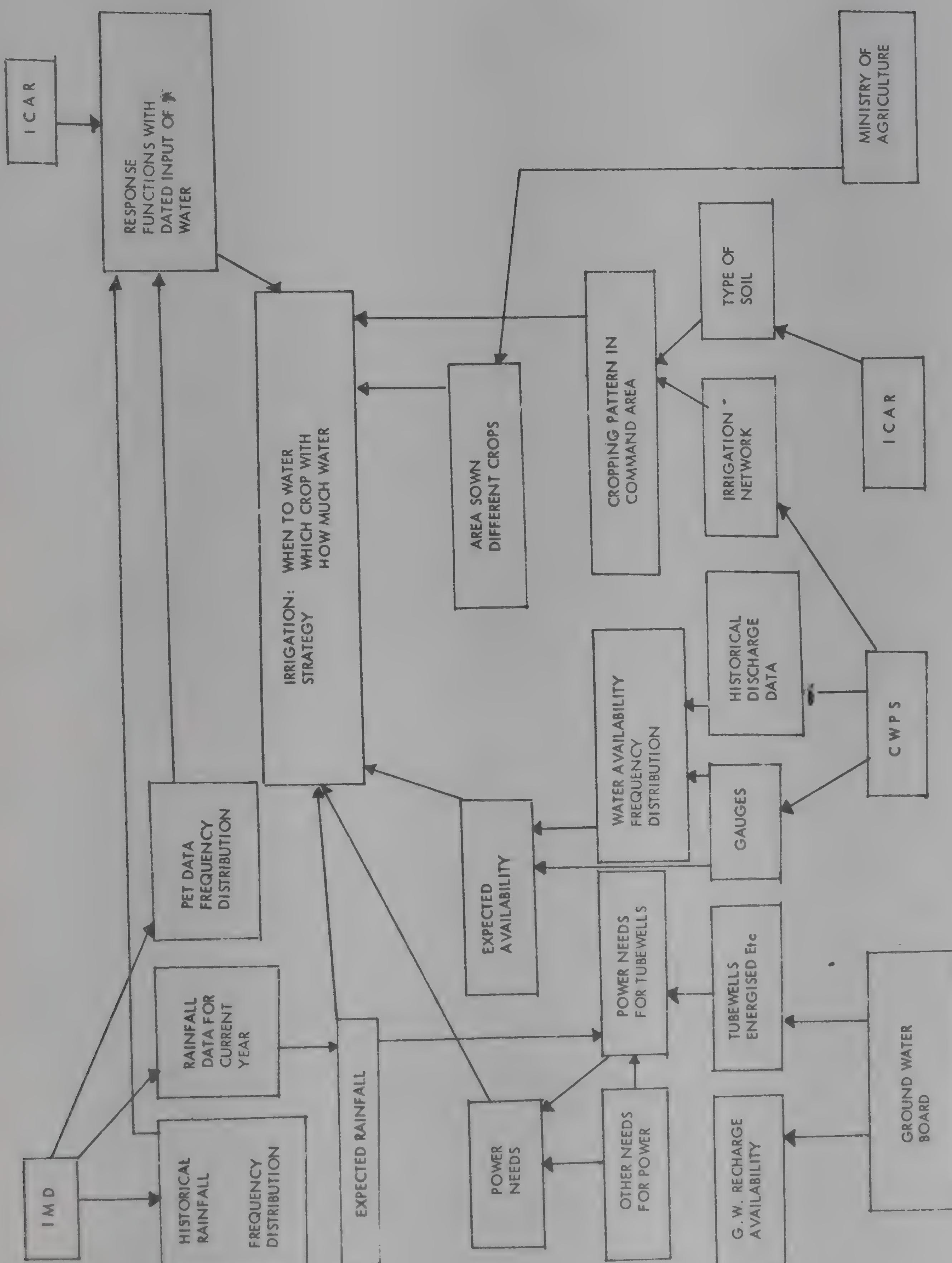
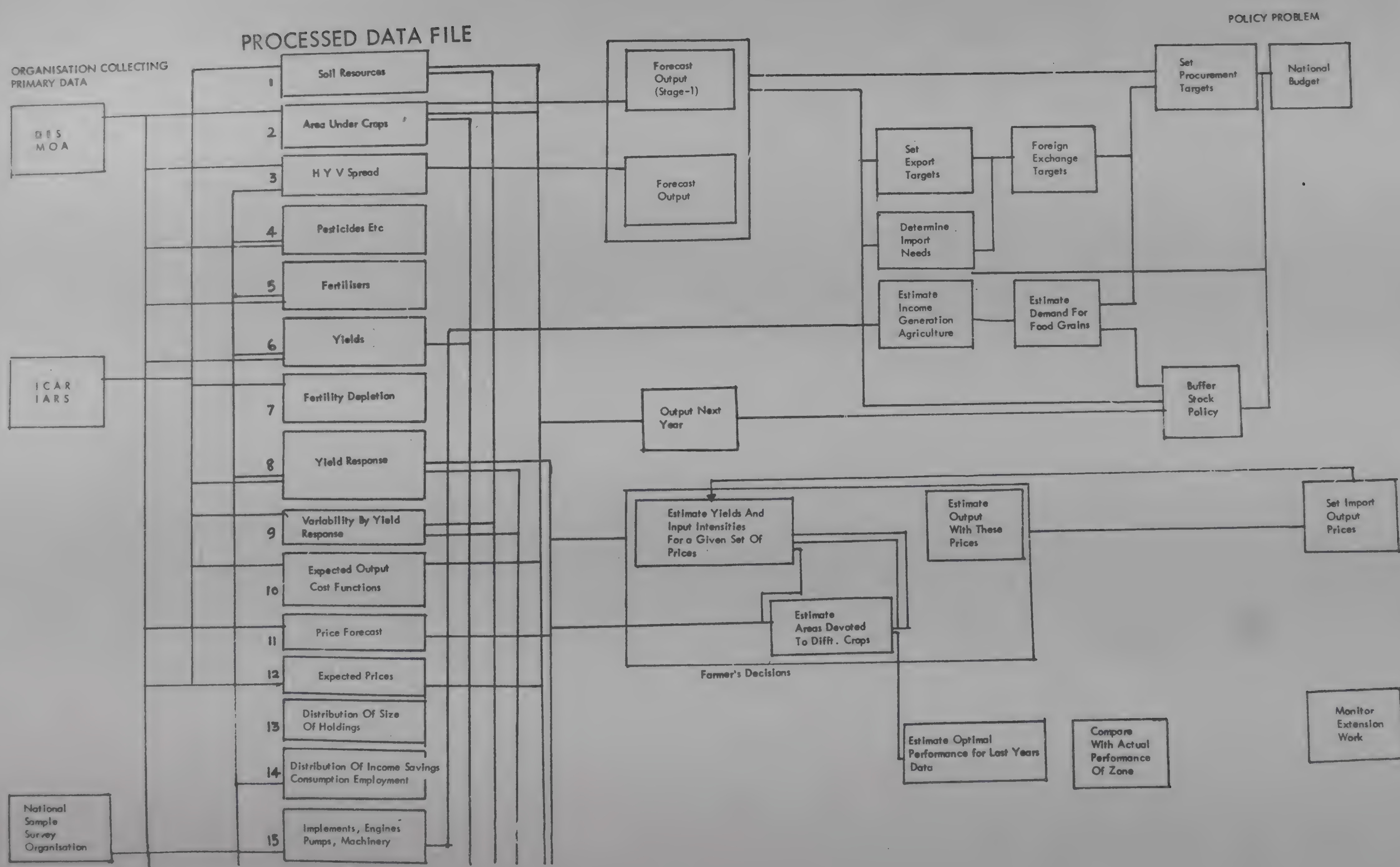
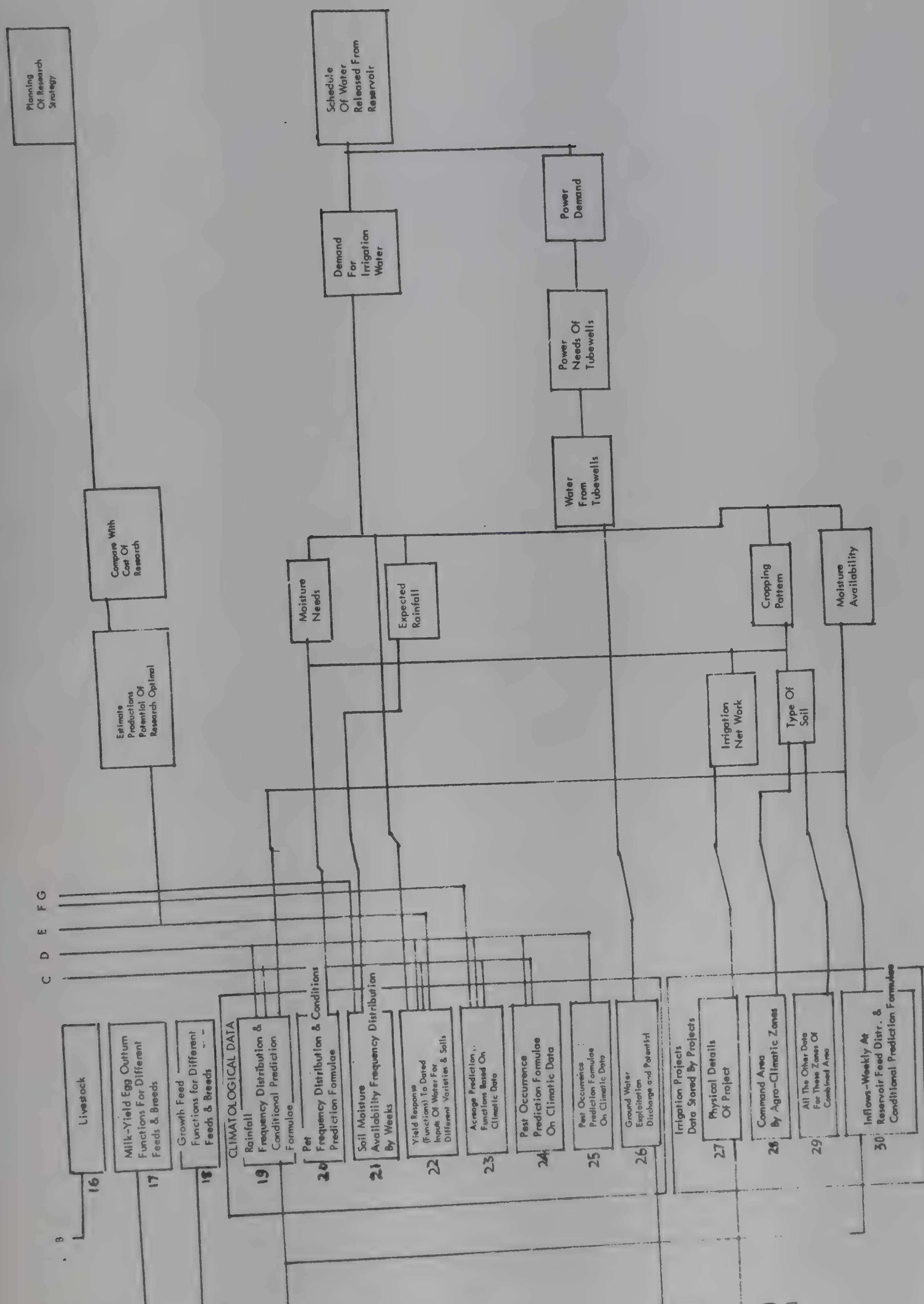


Figure 9. Planning Irrigation Strategy

Figure 10. General Flow Chart Of The System.





Planning Of Research Strategy
Schedule Of Water Released From Reservoir
Power Demand
Demand For Irrigation Water
Power Needs Of Tubewells
Water From Tubewells
Compare With Cost Of Research
Estimate Productions Potential Of Research Optimal
Moisture Needs
Expected Rainfall
Cropping Pattern
Moisture Availability
Irrigation Net Work
Type Of Soil
C D E F G
A
B
16 Livestock
17 Milk-Yield Egg Outturn Functions For Different Feeds & Breeds
18 Growth Feed Functions for Different Feeds & Breeds
CLIMATOLOGICAL DATA
19 Rainfall Frequency Distribution & Conditional Prediction Formulae
20 Pet Frequency Distribution & Conditions Prediction Formulae
21 Soil Moisture Availability Frequency Distribution By Weeks
22 Yield Response (Function) To Dated Inputs Of Water For Different Varieties & Soils
23 Acreage Prediction Functions Based On Climatic Data
24 Pest Occurrence Prediction Formulae On Climatic Data
25 Pest Occurrence Prediction Formulae On Climatic Data
26 Ground Water Exploitation Discharge and Potential
Irrigation Projects Data Stored By Projects
27 Physical Details Of Project
28 Command Area By Agro-Climatic Zones
29 All The Other Data For These Zones Of Combined Area
30 Inflows-Weekly At Reservoir Feed Distr. & Conditional Prediction Formulae
IMD
Ground Water Boards
CWPC

Table 1: Summary of Data Availability

Data	Basis (Organisation)*	Detail	Volume	Frequency of Collection	Form in which to be stored	Updating frequency	Limitations of Data
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Crop Area	Mostly Census Partly Sample (DES)	Area denoted to different crops Plot wise Village wise Tehsil wise District wise (Published)	70 million holdings 55 " villages 5000 tehsils 350 districts	Every season	Grouped by Agro-climatic zones based on Districts in stage 1 Tehsils in stage 2 Villages in stage 3	Every season	Treatment of mixed crops is not uniform in the country. Intensity and quality of Irrigation not differentiated.
	Sample Basis Timely Reporting System(DES)	"	20 percent of above	"	"	Middle of every season	"
	Sample Basis Improvement of agricultural Statistics-IAS Scheme(IES)	"	10000 villages a year	"	"	Every season	Carefully collected data upto 1971
Yield and Production	Sample of crop cutting experiments (IES)	Yield/hectare of different crops	150,000 cuts a year	Every season	Frequency distribution of yields, of different crop varieties in difft. agro-climate zones.	Every season	Upto 1971-72 there are two sets of unreconciled estimates due to difft. treatment of mixed crops. Only one estimate since then.
	Sample Basis IAS Scheme (NSSO)		30,000 cuts a year	"		"	
Soil Resources	Sample Survey (ICAR)		1300,000 samples a year	Every season	Area of different soil types in each zone	Every season	Does not fully cover the country
Adoption of New Technology	Sample Survey (IARS), (PEO) (MOA, FAI)	Area unless HYV Pesticides used etc. Fertiliser applied	50,000 farmers/ year	Periodic	Area under difft. Varieties in the zone; Freq.-Distribution of fertilizer dosages, amount of pesticides etc. applied to difft. crop varieties	Periodic	Sample size two small to get detailed regional data. Fertilizer data based on distribution and changes in stocks are not accounted for

D ta	Basis (Organisation)	Detail	Valume	Frequency of Collection	Form in which to be stored	Updating frequenc	Limitations of Data
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
						Based on distribution and not consumption and distribution does not cover HYV seeds grown by farmers.	
Sample IAS Scheme(NSSO)	Agricultural practices	30,000 fields a year	Every year	"	Every year		
Selected districts (DES)	Area under HYV	30 to 35 districts/ year	"	"	"		
Input-Output relationship for crops	Experimental schemes (ICAR, Agricultural Universities) IAS Scheme (NSSO)	For different crop varieties yield response to -fertilisers -micro-nutrients -cultural practices -soil type, structure -irrigation	30,000 plots a year	Every season	Estimated crop-wise variety wise yield response functions for difft. years grouped by agro-climatic zones.	Every season	Not all crops and all areas are covered. Water-yield relationship experiments almost absent Responses in experimental plots not representative of responses on farmers fields.
Cost of Cultivations	Farm Surveys and Comprehensive Scheme (DES)	Daily Cost and amount of inputs on the different plots of selected households	More than 7000 households per/ year. Monthly summarises alone need 5 million cards/year	"	Estimated Output cost functions for different crop varieties for different years grouped by agro-climatic zones.	"	Data not yet available for all crops and states.
Prices (a)wholsale	Market intelligence(DES)	Daily/Weekly Market prices, wholesale and retail prices	About 1000 Markets and 72 commodities	Weekly	Frequency distributions of prices over the year. Price forecast functions	"	
(b)retail	"	Retail prices of foodgrains and other essential commodities	100 markets	Weekly	"		
(c)Harvest	"	Farm Harvast prices.	All districts	Weekly			

Data	Basis (Organisation)	Detail	Volume	Frequency of Collection	Form in which to be stored	Updating frequency	Limitations of data
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
8. Market Arrivals/ disposals	Market intelligence (DES)	Daily/Weekly data	1000 markets	Weekly	Frequency distibution of weekly data	Every year	
9. a) Land Holdings and Tenancy	Agricultural Census(ACC)	Households Holding size, Tenancy status irrigation facility	70 million holdings	Periodic (every 10 years) (every 5 years on a sample basis)	Distribution of size of holdings by irrigation, soil type and agroclimatic zones	Whenever new data are available	
	Periodic Sample Surveys (NSSO)	"		Regularly, every year(?)	"		
(b) Income	Sample Surveys (NSSO)	Households Income Consumption Savings Employment	30000 households/ year consumption survey in recent years	Every year	Distribution of incomes employment, savings consumption nutritional level by agroclimatic zones.	Every year	
10. Animal Husbandry	Livestock Census(IES)	Livestock size and age composition by households	550000 villages	Every 5 years	Distribution of livestock etc. by agro-climatic zones	Every 5 years	Data on quality or breed of livestock not available.
Milk, Eggs Wool and Meat	Sample Surveys (IASRS), (NSSO) (Annual Husbandry Division of DES)	Livestock products		Periodic Every year	Distribution of production of different breeds Animal Performance histories		
Input-Output relationship for livestock products	Experimental schemes (ICAR)	Yield of different species to different feeds etc.	/year	continuing experiments	Estimated yield response, functions for animals of different brreds age etc. to different feeds in different climates	As and when new data are available	Inadequate experiments to derive yield functions.
1. Machinery Implements	Census (part of livestock census) (DES)	Ploughs, carts, crushers oil engines pumps etc. for households	550000 villages	Every 5 years	Distribution of households by size class of holdings and implements by agroclimatic zones	Every 5 years	Quality data on implements not collected.

Data	Basis (Organisation)	Detail	Volume	Frequency of Collection	Form in which to be stored	Updating frequency	Limitations of Data
1	2	3	4	5	6	7	8
	Sample(part of agricultural census)(NSSO)	"					
Investment and Credit	Rural Surveys (RbI)	Credits advanced for difft. purposes, investment made		Periodic		Periodic	Surveys are not regularly conducted for data on investment from farmers own resorces.
Fishery	Sample Basis (CMFRI)	Catch of marine fish variety, duration, type of equipment		Every year		Every year	No reliable data on inland fishing
	(NSSO)	Catch of inland fish		Occasional		Occasional	
3. Forestry	Survey (DES-MOA)	Area Volume of standing timber and firewood and outurn of various products		Every year		Every year	Data from only govt. forests available Production functions for different bio-systems not available.
14. Climatological Data							
(a) Rainfall	Observation network (IMD)	12 hourly rainfall	4000 stations nearly 100 year series for many station	Every day	All data AND weekly frequency distribution of rainfall by agroclimatic zones	Every year	
(b) Pan Evaporation and other determinants of evapo-transpiration	"	12 hourly readings		"	All data AND frequency distributions of PET by agroclimatic zones/stations	"	Pan Evap. network is too coarse.
(c) Consumptive use of water	Lysimetric observations network (IMD)	daily readings of soil moisture, PET and actual ET	200 stations	Every day	For different crops yield response to dated inputs of water at different stations.	"	Only a short time series available

ta	Basis (Organisation)	Detail	Volume	Frequency of Collection	Form in which to be stored	Updating frequency	Limitations of Data
1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(d) Yield and Climate	Experimental Farms (IMD)	daily readings on crop growth and weather Parameters	50 centres 30 years data	Every day	For different crops yield response to different climates at different stations.	"	
Irrigation							
( ) Irrigation Projects Physical data	Project reports (CWPL)	Reservoir capacity etc. Canal Network Command Area		Whenever a project is completed	Command area by agro-climatic zones and Canals		
Water inflows	observations (CWPC)	Acre feet/day		Every day	Frequency distribution of inflows for different weeks. Prediction formulae.	Every year	
(b) Water Availability in rivers	observations network (CWPC)	Thrice a day water levels Discharge per day	1003 gauges 1862 gauge discharge sites many years data	Every day	Frequency distribution of inflows for different weeks Prediction Formulae	Every year	Long Time series not available for all rivers
(c) Ground water availability	Survey (GWB)	Water Table	-	-	Potential of ground water by agro-climatic zones/districts/ Tehsils	"	Incomplete coverage
Ground water exploitation	- (STO's)	Tehsilwise Tubewells by types	-	Every year	Use of ground water by agro-climatic zones/ districts/Tehsils	"	Incomplete coverage

Table 1 (Contd.) footnote

*(DES) Directorate of Economics and Statistics, Ministry of Agriculture
(ICAR) Indian Council of Agricultural Research
(PEO) Programme Evaluation Organization, Planning Commission
(MOA) Ministry of Agriculture
(ACC) Agricultural Census Commissioner
(IARS) Institute of Agricultural Research Statistics
(CMFRI) Central Marine Fisheries Research Institute
(CWPC) Central Water and Power Commission
(FAI) Fertiliser Association of India
(NSSO) National Sample Survey Organisation
(RBI) Reserve Bank of India
(IMD) India Meteorological Department
(GWB) Ground Water Board
(STO) State Tubewell Organization

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PAPER. D-7

AGRICULTURAL INFORMATION SYSTEMS

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0 Introduction

Advancement of Science and Technology has given rise to a proliferation of scientific literature and information and the same hold good for Agricultural Sciences & Technology. The sophisticated communication system and electronic data processing equipments have opened up new vistas in the field of information handling. As a result, several global information systems like UNISIST, INIS, AGRIS, CARIS and DEVSIS have emerged in recent years.

In the field of Agricultural Sciences, the FAO of United Nations came up with two global information systems and requested the member countries to cooperate in their venture. The Government of India took a decision in July 1974 to participate in the International Information System for Agricultural Sciences and Technology (AGRIS) at a national level through a National Input Centre under Indian Council of Agricultural Research. At the request of FAO the Government of India also decided to participate in the Current Agricultural Information System (CARIS) in September, 1975. The Indian Council of Agricultural Research strongly feels that in any National Information System, Agricultural Sciences and Technology should play a major role because it is so vital to the basic needs of the millions of people i. e. food and nutrition. Secondly, it has the largest infrastructure in Research and Development in the country with number of Research Institutes, Laboratories, Projects, Programmes, Agricultural Universities and Scientists. Thus the explosion of scientific literature and information in agriculture has outnumbered in any other field of Science in India.

1 AGRIS - International Information System for Agricultural Sciences and Technology

The AGRIS was conceived when a number of organisations providing or planning to provide information services in the field of food and agriculture approached the Director General of FAO in 1969 and requested him to sponsor a meeting of Experts to investigate what might be the possibilities and advantages of cooperation. The Expert body recommended that FAO should sponsor the development of an International Information System for Agricultural Sciences and organised at two levels.

AGRIS Level One is a cooperative, comprehensive and rapid current awareness service covering all the subject field of FAO's interest, with FAO acting as Coordinating agency.

Level Two is a network of services - grouped by subject field or mission including specialised information services, data banks and data handling services which would provide specific information through abstract services, intensive index and other form of specific and direct services to users.

The AGRIS 'Level One' is to provide all countries the comprehensive current awareness service in all fields of interest of FAO, consisting of a current bibliography in printed form and also on magnetic tape. The 'Level One' became operational in January, 1975 with the publication of monthly AGRINDEX. The AGRINDEX has broadly 150 subject headings and sub-headings. Each item has a unique reference number. The authors' names are given first. The affiliation of first author is also cited thus enabling the user to identify the work and communicating directly with the author. The title is followed by the conventional information required to identify and describe the document: its language, a journal title, a report number, the place and date of publication and publishers, volume and issue number, number of pages, availability of original document in case of non-conventional literature. On the magnetic tape, all elements of description are 'tagged', making it possible to select, by computer, items by other facets than those displayed in the printed index.

The AGRIS System in more compatible to the International Nuclear Information System (INIS) of IAEA and the maintenance of AGRIS programme is being done at INIS Data base at Vienna. It is expected that the annual input of AGRIS will be 2,50,000 items per annum against 1,00,000 inputs of INIS.

The ICAR has started sending Indian inputs from May, 1975 for the AGRIS Data base at Vienna for publication in the AGRINDEX. At present about 150 inputs per month are being sent and it is expected that about 200 inputs will be sent from January next. The first Indian input appeared in the August, 1975 issue of AGRINDEX, Vol. 1(8) and India is one of the 15 Input Centres in the world which is submitting inputs to AGRIS Data Base. About 200 Indian Serials - cover to cover and core journals - have been selected for inclusion in the System besides non-conventional ones.

2 CARIS - Current Agricultural Research Information System

The CARIS project aims at establishing an international information system which would collect, organise and disseminate basic data on current research in the field of agriculture, animal production, forestry, inland fisheries and food and mainly on research institutions, research workers, programmes and activities carried out in or on behalf of the developing countries in order:

a) to improve communications between institutions and between scientists,

b) to assist in the evaluation of the adequacy of existing research effort, and the identification of major gaps and weaknesses, as an aid to decision making at both the national and international level.

It is not an abstracting service providing summaries of past results (this aspect will be covered by AGRIS) but a System aimed at providing and maintaining current awareness of what is going on in agricultural research, where and what resources, aimed primarily at assisting the developing countries, but also generally serving world agricultural development.

The global project is expected to collect information from some 1600 research institutions involving 7000 research workers, 8000 research lines and some 30,000 research projects.

In the initial stages, the project will be limited to the information concerning 1) research institutions, 2) research workers, and 3) main lines of research (or programmes).

The local CARIS Centre would be in charge of data collecting, indexing and processing and of disseminating of information, through services to users in their respective areas. CARIS Coordinating Centre would ensure the exchange of information on a world wide scale by merging information from local CARIS Centre.

The information system envisaged by CARIS project of FAO is already being carried out by the Research Project Unit of I.C.A.R. since 1967, which was established on the model of Current Research Information System (CRIS) of USDA. The Unit is responsible for collection, collation, indexing, documentation and dissemination of all on-going agricultural research projects in India. Both the FAO Projects - AGRIS and CARIS are being handled at a national level by the Research Project Unit of the Council till a full-fledged computerised Agricultural Research Information and Documentation Centre is established under I.C.A.R.

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BRANCH INFORMATION SYSTEM

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1 NISSAT

The Science and Technology Plan, which forms part of the larger socio-economic plan (Fifth Five Year Plan) of the country, includes a proposal for the evolution and development of a National Information System for Science and Technology (NISSAT) towards building up a strong information infra-structure for supporting our R&D activities. Interlinking and coordination of the large number of existing information sources, systems and services and thus creating an effective information network under an overall coordinating agency, upgrading the existing centres and augmenting the facilities where necessary and establishing new centres for areas not covered already are the main prongs of activity envisaged under NISSAT. The NISSAT would be a multi-tier organisation consisting of National Information Centres (NCs), Regional Information Centres (RCs), Branch Information Centres (BCs) and Local Information Units (LIUs). The Department of Science and Technology (DST) is now actively engaged in implementing programmes for the development of NISSAT.

2 Branch Information Centres

The BCs are the most important subsystem of NISSAT. They are either subject-oriented or mission-oriented information networks. They are mostly devoted to industrial areas. They play a significant role in collection and dissemination of information to every kind of users belonging to a particular discipline or mission. In the total system, these sectoral information centres assume responsibility for offering specsialised information services on a nation wide basis to all the institutions belonging to the branch, to other institutions who may have occasional interest in the particular subject field or mission of the branch and to individual users. They are the nodal points for establishing linkages between the NCs at higher level and the LIUs at lower level.

21 Functions

The functions of BCs would be:

1. to provide the following services:

   (a) Specialised indexing and abstracting services for current awareness purpose, including SDI

(b) Retrospective subject bibliographies
(c) Subject union catalogues
(d) Information retrieval and service on request
(e) Information on patents, standards, specifications, etc.
(f) Scientific, technical and economic data service
(g) Computer-based information service in cooperation with NCs and ensuring national and international compatability
(h) Translation and document supply
(i) Literature surveys, state-of-the-art reports, scientific and technological forecasting and other types of techno-economic and special management information;

2. to build up and maintain a document collection, supplementing that of the institutions in the branch;

3. to assume responsibility for coordination of information services within the branch;

4. to offer training facilities for taking care of manpower requirement;

5. to promote creation and development of LIUs by offering advisory service and assistance in information system design, etc; and

6. to develop relations and maintain cooperation with foreign information centres, R&D institutions, professional bodies, etc for ensuring exchange of information.

22 Users

The BC and the LIUs of one and the same mission or discipline form a grid of their own, with the BC functioning as the focal point for planning, development and coordination of resources and services. The BCs would cater to the information requirements of users of LIUs in R&D establishments, government departments and agencies, industries-large, medium and small and societies and associations. They would serve the information requirements of scientists and research workers, development and production personnel and planners and administrators.

23 Organisation

To begin with, the BCs would be established around the nucleus of the most suitable LIU which has already developed a strong information base. They may also derive institutional support of the parent organisation. However, this arrangement may be transitional and the BCs would have to develop themselves eventually into separate and independent institutions and run on a self-supporing basis. A suitable machinery has to be evolved for maintaining and operating the BCs. They may be independent in their set-up, administratively responsible to the appropriate science agency and technically sharing responsibility under NISSAT. They may be advised and guided by a representative body of institutions and users of the system.

The BCs would be conceived and developed in a manner that they are run on a self-supporting basis in the course of time. The services have to be paid for by the users so that the revenue may take care of the establishment. But it may take some

time to reach the take-off stage. Till then, it has to be financially supported through external sources of revenue, by the parent institution and by all the LIUs of the branch on an agreed basis.

3 Systems Approach

31 Information Resources

The BCs would build up a document collection by way of supplementing the resources already available in their LIUs. The BCs would only acquire material not likely to be acquired by their LIUs, such as those falling in the category of costly material, items difficult to locate and procure such as conference proceedings and industrial research reports, foreign language publications, standards, patents etc. A fairly complete collection of indexing and abstracting services and reference material would be maintained by the BCs. They may also collect and maintain a depository of unpublished literature such as theses, research and development reports, trade literature , etc. The entire resources available in the BCs and their LIUs are accessible to all the users in the system. For this purpose, the BCs may bring out union catalogues of material available in the system. Access to respurces available in the system would be made possible through provision of reprography facilities, not only in BCs but also in all their LIUs. The aim would be to ensure that every thing worthwhile being published in the subject fields or missions is acquired and made accessible throughout the system.

32 Services

The BCs would select, evaluate and synthesise information in well defined special fields and or in areas pertinent to specific mission and present it throughout the network in a form best suited to the needs of users, either in research, technology or management. The services offered by the system as a whole are expected to play an essential part in the flow of information by maintaining close touch with the status of current scientific and technical research and practice at the BCs and by continuing close association with the users in the LIUs. It may not be necessary that all the services have to be organised only at the BCs. It is possible that some of the LIUs might have already developed expertise and facilities for offering a particular type of service. In such cases they may be continued and if necessary broad based. Some of the mechanised services like SDI, establishment of data bank, and translation service would be centralised in the BCs. Reprography facility may be set up in LIUs also, through on a small scale, while physical production of information publications will be handled by the BCs.

33 Standardisation

All the components of a branch information system are to be considered holistically as a part of a single system. Therefore, there should be compatible standards for information techniques and methods, not only for interchange of information within the branch but also for exchange of information at national and international levels. The promotion of standard practices in information work would be taken care of by the NISSAT and the BCs would have responsibility to enforce their adoption. The standards already evolved by international and national bodies may form a basis for following uniform practice through out the system.

4 Implementation Programme

Among the four levels of NISSAT, the BCs were perhaps non-existent before, atleast formally. The absence of this important subsystem was being felt keenly. It was also realised that in developing national information infra-structures, subject specialised information centres constitute a vital link and that they have to be provided for. While some attempts have been made successfully in early seventies, systematic planning for the development of BCs began to receive attention after the advent of NISSAT.

Much earlier than NISSAT was contemplated in 1973, proposals were mooted for the creation of BCs in food by the Central Food Technological Laboratory, Mysore, aeronautics by the National Aeronautical Laboratory, Bangalore, leather by the Central Leather Research Institute, Madras and machine tools by the Central Machine Tools Institute, Bangalore. The plans drawn for the establishment of these BCs have been considered at various forums and accepted. They have been ready for implementation for a long time. When NISSAT came into being, they were naturally thought of as the first ones to be supported under its auspices. The plans of these centres have singly and jointly provided model for the subsequent ones. They offered several guidelines in system design and for drawing up action plan. In many respects, they are the pace-setters for the establishment of BCs in our national system.

The S& T Plan also includes proposals for establishment of an information Centre for housing and construction technology, and National Water Data Bank. The R & D Unit of Bharat Heavy Electricals Ltd, Hyderabad has also plans for setting up an information centre for heavy electrical engineering.

Realising that a number of CSIR laboratories and Cooperative Research Associations offer scope for establishment of BCs devoted to industrial disciplines, Insdoc, in order to enable them to draw up suitable plans, organised a Workshop on the Planning of Branch Information Centres in CSIR, during February 25-27, 1975. The Workshop considered as case study the plans of BCs in food, aeronautics and leather and several other papers relating to planning processes. A number of guidelines for preparing plans for setting up BCs were drawn. The recommendations made at the Workshop served as a catalyst for many CSIR laboratories to come up with proposals for establishment of BCs in their areas of specialisation.

All the proposals which have emanated from CSIR establishments are now with the Department of Science and Technology, after having been supported and duly forwarded by CSIR. In addition, proposals of Machine Tools Information Centre, Housing and Construction Technology Information Centre, and Patent Information Centre are with the Department. The various proposals are now under consideration of the Department for support in the NISSAT scheme. A summary of the proposals so far available for setting up BCs is given in the table at the end. It is expected that financial clearance to the entire NISSAT scheme would be obtained shortly, and that the proposals for establishment of BCs would thereafter receive necessary support from the Department of Science and Technology. It is possible that some token grant may be made available in this year for the information centres in food, aeronautics, leather and machine tool. From next financial year, not only the above four centres may receive necessary support according to plans drawn by them, but the other proposals may be also taken up for implementation. If atleast 20 BCs come up during the Fifth Plan, we might have made a good progress to develop the national information infra-structure.

TABLE

SUMMARY OF PROPOSALS FOR SETTING UP BCs

Sr. No.	Name of the BC	Sponsoring Institution	Plan Outlay (in lakhs of rupees)		Services and Facilities	Remarks
1	2	3	4		5	6
1	Food Science and Technology Information Service (FOSTIS)	Central Food Technological Research Institute, Mysore	Recurring		Document Acquisition and Processing (Document procurement, Reprographic copies and translation, Technical processing, Document circulation, Inter-library loan, Maintenance)	Central Facility at CFTRI, Mysore and Regional facilities at CFTRI Experiment Stations in different places
			Documents	16. 250		Membership fee as a source of revene contemplated
			Staff salary	19. 200		
			Furniture & Equipment	0. 250		
			Services (Binding, Computer hire)	1. 750		
				37. 450		
			Non-Recurring		Documentation Service and Facilities (Reference service, Referral service, Documentation work and service, Data bank, Research, In-service training, Refresher courses)	
			Documents (Block grant)	7. 500		
			Equipment (Reprography, Data processing and Office)	2. 950		
			Library Building	15. 600		
			Furniture	1. 500		
				27. 550		
			Total	65. 000	Promotion of Information Use in Industry (Contact with industry, Industry/product/user profile preparation, Directory preparation, Research in Progress, Sources of Information, Advisory service).	
					Reprography, Printing and Publications	

1	2	3	4		5	6
2	Information Centre for Aeronautics	National Aeronautical Laboratory, Bangalore	**Recurring**			
			Documents	35.000	Library Services (Acquisition, Circulation, Readers Service, Inter-library loan etc)	In the outlay, the non-plan grant to be met by CSIR is about Rs. 34.600 lakhs and the remaining Rs. 63.450 lakhs would be additional requirement under NISSAT. The foreign exchange content is Rs. 3.450 lakhs.
			Staff salary	19.300		
			Imported Data Bases	1.950		
			Services	1.500	Information Processing, Storage and Retrieval (Classification and indexing, processing of documents, storage, retrieval)	
			Special Projects	1.000		
				58.750		
			Non-Recurring			
			Equipment (Reprography, Data Processing, Office)	4.000	Information Analysis (Literature search and bibliographies, Trend reports, Reviews, State of the art reports, Data compilation, Central Information Index and Data bank)	
			Building	20.000		
			Furniture	5.000		
			Documents (Block grant)	10.000		
			Audio-visual material	0.300		
				39.300	Information Dissemination (Accession List, CAS, SDI, Abstracting & Indexing service, Digests, News brief, Product information, Translation, Reference/Referral, Document reproduction, Promotion of use)	
			Total	98.050		
					Liaison (Liaison with international and national centres, industry and institutes, User surveys, Preparation of directories, Advisory and Consultancy, Public relations, Training)	

3	National Information Centre for Leather (NICL)	Central Leather Research Institute, Madras	<u>Recurring</u>		Information Promotion & Advisory Services Library and Referral Services Documentation Services (Retrospective, Current Awareness, Abstracting, SDI, MIS, Data bank, etc) Editorial, Printing and Reprography Services R&D Consultancy and Training Programmes	In the outlay, the non-plan grant to be met by CSIR is about Rs. 25.550 lakhs and the remaining Rs. 74.418 lakhs would be additional requirement under NISSAT. Equipment and machinary will be complemented by UNIDO grant of $ 75,000 already sanctioned
			Staff salary	61.244		
			Contingencies	8.615		
			Maintenance	0.350		
			Chemicals	1.100		
				71.309		
			<u>Non-Recurring</u>			
			Building	10.000		
			Machinery	6.175		
			Furniture	2.189		
			Books	10.000		
				28.364		
			Total	99.673		
	National Information Centre for Machine Tools	Central Machine Tools Institute, Bangalore	<u>Recurring</u>		Library Services (Acquisition, Storage, Retrieval, Circulation and Reference) Documentation (Abstracting, Analyses and Syntheses Reporting, Translation, Information Retrieval, Documentation Services) Data Processing (Programming & systems, Input, Processing and Information Retrieval, Output) Data Centre (Census, Market Statistics, Group Technology Survey Data, Materials, Products, Accessories) Public Relation and Publicity Patent Information Service Reprography, Printing and Audio-visual aids Training & Personnel Development	
			Staff Salary	35.670		
			Documents	6.070		
			Data Processing hire charges	2.000		
			Contingencies	6.000		
				49.740		
			<u>Non-Recurring</u>			
			Building	13.500		
			Documents	59.000		
			Reprography & Printing equipment	4.591		
			Data Processing equipment	25.000		
			Furniture & Equipment	7.780		
				109.871		
			Total	159.611		

1	2	3	4	5	6
5	Information Centre for Housing and Construction Technology		**Outlay on Functional Basis** Survey of available information services 0.500 Development of Central Information Organisation Acquisition of Literature 12.500 Equipment 13.000 Journal on Housing & Building 3.000 Translation Service 5.000 Abstracting Service 5.000 Publicity 3.000 Seminars, Symposium, Workshop 2.000 Personnel 10.000 Contingency 2.000 Establishment of new regional information cells and strengthening of existing information units in specialised areas such as CBRI, CRI, SERC, etc, about 6 Units - Building Data Centres 44.000 Total 100.000		The proposal has emanated from the Panel on Housing, Urbanisation and Construction Technology of NCST and forms part of the S&T Plan. No indication of the location of the Central Information Organisation is available.

6	Instruments Data Centre	Central Scientific Instruments Organisation, Chandigarh	Recurring			
			Staff Salary	21.000		
			Stationery & Postage	1.800		
				22.800		
			Non-recurring			
			Equipment	1.020		
			Furniture	0.510		
				1.530		
			Total	24.330		
7	Information Centre for Drugs and Pharmaceuticals (ICDP)	Central Drug Research Institute, Lucknow	Recurring		Current Highlights Service	The development will be in four phases beginning from 1975-76. In the Sixth Plan, printing Unit and a separate building are envisaged.
			Staff Salary	10.716	SDI	
			Contingencies	2.650	Survey of Information Potential	
			Documents	3.000	Data Bank	
				16.366	Strengthening CDRI Library	
			Non-recurring		Setting up Reprography Unit	
			Machinery	2.030	Preparation of Status reports	
			Total	18.396	Translation	
					Mechanisation of Information Service	
8	Branch Information Centre for Metallurgy (BICM)	National Metallurgical Laboratory, Jamshedpur	Recurring		Document Procurement Service	
			Documents	6.000	Compilation of Bibliographies	
			Staff Salary	11.442	Answering technical queries	
			Contingencies	1.558	SDI	
				19.000	CAS	
			Non-recurring		Translation Service	
			Building	3.750	Abstracting Service	
			Machinery & Equipment	6.096	Express Information Service	
			Others	0.904	Data Bank	
				10.750	Reprography Service	
			Total	29.750		
9	National Information Centre for Electrochemistry (NICE)	Central Electrochemical Research Institute, Karaikudi	Recurring		Library & Referral	
			Staff Salary	5.670	Documentation Service (Retrospective and Anticipatory, Translation, Reprography)	
			Working Expenditure	0.750	Central Information File	
				6.420	Editorial Publishing, Printing Reviews	
			Non-recurring		Research and Training Programmes	
			Building	11.500		
			Documents	4.600		
			Equipment	3.250		
				19.350		
			Total	25.770		

1	2	3	4		5	6
10	Information Centre for Essential Oils and Aroma Chemicals	Regional Research Laboratory, Jammu	Staff Salary	2.066	Publishing monographs and forecast trends Commercial Catalogues Acquisition Document Collection & Service Documentation Service on demand and in anticipation Information Bank, Clearing House Industrial Profiles Translation, Reprography Liaison Union Catalogues Promotion of Information Use	Only staff requirements are mentioned in the proposal. Further a sum of Rs. 64,756 is available in non-plan grant of CSIR for the existing posts.
11	Branch Information Centre for Wood Science and Technology	Indian Plywood Industries Research Institute, Bangalore	Recurring Documents Staff Salary Non-recurring Equipment Total	 5.320 5.730 11.050 2.380 13.430	Library Documentation Dissemination Public Relation Reprography, Printing, Audio-visual Industrial Information Service Patent Information Service	
12	National Information Centre for Raw Materials and Industrial Products (NICRIP)	Publications & Information Directorate, New Delhi	Recurring Staff Salary Working expenditure Non-recurring Equipment, etc. Total	 4.440 0.170 4.610 3.066 7.676	Library Reference Statistical & Data Compilation Communication Reprography Training Programme	A part of the expenditure will be met from non-plan grant of PID/CSIR
13	Information Centre for Science Policy Studies	Planning Division, Council of Scientific and Industrial Research, New Delhi	Recurring Staff Salary Contingencies Non-recurring Equipment Total	 3.489 0.750 4.239 1.634 5.873	Document Acquisition Compilation of Bibliographies Preparation of S&T Country Profiles Publication of Current Literature of Science of Science Participation in SPINES programme of UNESCO	

14	National Information Centre for Environmental Engineering (NICEE)	National Environmental Engineering Research Institute, Nagpur	<u>Recurring</u>		CAS, SDI, Bibliography Compilation, Technical Enquiry, Literature Search, Referral, Reprography, Digests, Abstracts, Data Bank, Translation, Editing and Production, Information Dissemination, Package Information, Press clippings, Training, Extension, Directory Compilation
			Documents	2.000	
			Staff Salary	5.500	
			Printing, Production, Distribution	1.500	
				9.000	
			<u>Non-recurring</u>		
			Furniture & Equipment	6.000	
			Building	4.000	
			Total	19.000	
15	Patents Library and Information Centre	Office of the Controller-General of Patents, Designs and Trade Marks, Bombay	<u>Recurring</u>		Acquisition of Documents including patents of important countries, Patent Abstracts, etc. Documentation Service (Classification of Patent literature, Preparation of abstracts and indexes) Dissemination Service through several types of services, products and publications, Translation Service, Reprography Service, Printing facility
			Staff Salary	122.500	
			Contingencies	5.000	
				127.500	
			<u>Non-recurring</u>		
			Land & Building	80.000	
			Equipment	11.000	
			Documents	101.000	
				192.000	
			Total	319.500	

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INDIAN AGRICULTURAL DATA AND INFORMATION

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Gives statistical data sources, information sources on research project files, output of scientific papers, various germplasm, insect, fungi and related collections, collections of plants, information on economic plants, soils, seeds, fertilisers, pesticides, etc.

0 *Scope of Agricultural Information*

The problem of agricultural information is a very complex one. Due to population pressure, agricultural information is also getting more and more importance as we are in the process of modernising our traditional agriculture into an industry.

Users of this information are of diverse groups. On one hand we have highly specialised research workers, and on the other hand we have illiterate farmers, who have inherited the traditional skills and want to learn or are to be educated on the modern skills. In between we have technical personnel, administrators, bankers businessmen, industrialists, extension workers, skilled and semi-skilled workers, etc. etc.

We are trying to look in this article at various institutions, organisations, societies, etc., where information is generated or received, stored and disseminated in various forms.

We are fully aware that we have to cover a very large area and can only touch on the fringe of the problem. Within the short available time, we have gathered some information which may be of interest to the gathering of specialist assembled here. We have attempted to present the available information about Indian data, and have briefly stated about the international information sources.

1 *Statistical Information: All India*

1.1 At the Centre, the Directorate of Agricultural Economics and Statistics is the most important organisation devoted to this work. It collects, collates and disseminates various types of information on agriculture. This is done by this organisation by way of publishing a number of periodicals and other related publications.

The subjects covered by this organisation encompass a large number of agricultural aspects, some of which are given below:

Indian Agricultural statistics, Agricultural prices, Commercial crop statistics, Indian forest statistics, Estimate of area and production of principal crops, Agricultural wages, Indian livestock census, Food statistics,etc. It also covers Studies in the economics of farm management, Agricultural legislation,etc.

1.2 *Fertiliser Statistics (Annual)*

The Fertilizer Association of India publishes this annual by compiling data from various governmental sources and industry. This incorporates scattered, published as well as unpublished data, about fertilizer and its related aspects. It compiles detailed statistical data regarding production, raw materials, imports, distribution, consumption, summary tables, prices and subsidy of fertilizers. The Association also includes in its statistical compilation data pertaining to soil testing, soil nutrients and their utilisation, index number of crops, agricultural production and productivity, area and production, imports and storage of food grains, population and agricultural economy and world's statistics of fertilisers and agriculture, etc.

1.3 *Census Reports*

The value of various census reports needs no elaboration as a data source of information. The various publications issued for the 1961 census, and the new reports coming out of the 1971 census, form a very valuable source of data for agriculture.

1.4 *Agricultural Census*

The agricultural census was conducted in order to make a complete enuneration for the 1st time with 1970-71 as the reference year for the purpose of participating in the 'Third Decennial World Agricultural Census' sponsored by FAO of UN. This census would provide data on the structure of agriculture holdings and their main characteristics viz., number and size distribution of operational holdings, area under principal crops, land utilisation statistics, irrigation, tenure and tenancies, etc. The field work and tabulation of data on the project has been completed and statewise reports giving the census results have been prepared. The consolidated draft of All-India report will be shortly released after the secrutiny of technical experts in the field.

1.5 *Export & Import*

The Department of Commercial Intellegence and Statistics of the Government of India compiles, maintans and publishes the data pertaining to export and re-export and import of various commodities of India. The agricultural commodities are also covered. It publishes the 'Monthly Statistics of Foreign Trade in India'.

1.6 *State Level Statistics*

One of the most important publications issued by the States in the country relates to 'Season and Crop Reports'. These are compiled and published by their Departments of Statistics, Bureau of Economics or similar other organisations. Various agricultural universities are also publishing handbooks, etc. in which information about statistical data on agriculture for the individual State is given.

It is not possible for us to deal elaboratively on this aspect here. But the following 2 publications are worth mentioning which give details of statistical sources.

Bansel, P. C.: Agricultural Statistics in India, Dhanpat Rai & Sons, Jullundur, 1970

Ministry of Food & Agriculture, Directorate of Economics and statistics: Guide to Current Agricultural Statistics, 1954.

2 *Research & Teaching*

At present, in India research, teaching and extension activities are being done by various agencies. In research field, the ICAR is the apex body. It has over 24 research institutes under its administrative control, supports over 20 agricultural universities and also sponsors and supports about 80 All-India Coordinated Projects of Research in the country. There are 105 colleges of agriculture, animal husbandary, veternary and diary science and agricultural engineering in the country. Many of these colleges are attached with agricultural universities. In addition to these there are some independent State research institutes,etc. Some institutes under CSIR complex are also conducting research on plant and animal sciences. At BARC, research on nuclear energy in relation to agriculture is being done. Surveys, like Botanical Survey of India, Zoological Survey of India and Geological Survey of India carry out surveys and publish information, which is of interest to agricultural scientists. The Central Water & Power Commission, the India Meterology Department and general universities also conduct research, which is of interest to agriculture. Apart from these, we have the Indian Standards Institution and the Patent Organisation, which have standards and patents of agricultural interest.

Information and data, which is either generated or is of direct interest to research workers in the field of agriculture is given below:

2.1 *Projects of Research*

The projects of research carried out by research institutes get listed generally in their annual reports. Very few reports, however, are up-to-date. Recently INSDOC has compiled and published 'Current Research Project in CSIR Laboratories 1972'. This list covers 1925 current projects of research in 39 organisations under CSIR. INSDOC has also compiled and published information about the projects of research in science and technology in Indian Universities and research organisation. It includes 9,908 projects out of which 3374 are on agriculture. The Research Project Unit of ICAR maintains the file of research projects in the ICAR system and agricultural universities. About 5,400 projects of research have been listed by this unit.

If similar information is compiled and published by the various agencies like the Atomic Energy Commission and other public and private sector R & D organisations it will be a great asset for the scientific community in our country. They will be able to avoid duplication of research and establish contacts with scientists working in their areas of interest.

2.11 *National Index of Field Experiments*

The Institute of Agricultural Research Statistics maintains data on field experiments conducted throughout the country. It has already published data for centre

as well states about these for the years 1948-53 and 1954-59. It also maintains further data on these experiments. As and when more sophisticated computer facility is available it will be computerising data for retrieval of information on demand.

2.12 All-India Coordinated Research Projects

Coordinators of the ICAR All-India coordinated projects maintain data on the various projects, which are accepted by the All-India Workshops on various crops. They also maintain retrospective data about the projects.

2.2 Output of Scientific Papers in India

The output of scientific papers, published in the scientific journals are, currently monitored for publishing abstracts, indexes and for building and retrieval of information files. It is estimated that at present there are 8000 to 9000 contributions in agrobiological area on plant sciences.

INSDOC publishes the 'Indian Science Abstracts' which has listed in 1972, 13404 abstracts of papers on science and technology.

IARI Library: It scans more than 350 Indian and 500 foreign periodicals and indexes more than 8000 papers annually, contributed by Indian scientists and foreign, as well as on Indian agriculture and related subjects. This activity was started in 1944 and has continued till date without break. The library has built a collection of more than 45,000 references in its Indian Agriculture Reference Media for retrospective literature search. The subject part of the media is kept in classified order according to UDC scheme and author part in the alphabetical order of the author's name.

Wealth of India: For this project, Indian as well as foreign periodicals are scanned and a retrieval of information file has been maintained according to genera and species of plants and on animal sciences, minerals and industries under the popular names. The project has about 200,000 references in its file.

2.3 News Paper Cuttings

The information published in newspapers relating to agriculture is of interest to workers engaged in sociology and economics of agriculture. Some of the important agencies who monitor and keep data are:

1) Delhi Library Association: Publishes Indian Press Index.

2) 'The Data India', is published by Press Institute of India.

3) United News of india, publishes annually 'Aspects of Agriculture in India'.

2.4 Books & Monographs

A complete retrospective bibliography of publications of interest to the agrobiological subjects in India is not available. Information gathered from a few sources gives some data about it.

a)	CSIR: Indian Scientific & Technical Publications Exhibition, Bibliography, 1960	English Book = 1200 Indian Languages = 534
b)	CSIR: Indian Scientific & Technical Publications Bibliography (1960-65)	
c)	Books in Print, India (1973)	1357
d)	Bibliography of ICAR Publications	947
e)	Indian Books 1974-75: Annual bibliography	350 of agricultural interest.

2.5 *Germplasm Collection*

A national collection of germplasm for seed varieties of various crops is likely to be maintained when the Plant Introduction and Explanation Organisation is established.

At present, various ICAR institutes and agriculture universities are maintaining the germplasm collection. The Genetics Division of IARI maintains germplasm collection for wheat, pulses and maize. Central Rice Research Institute for rice and similarly various single crop research institutes maintain germplasm of the crops they specialise. The ICRISAT is maintaining germplasm on sorghum, millet, chick pea & pigeon pea. Plant introduction Division, IARI maintains in medicinal plants, etc.

Vegetable Crops

The vegetable coordinator at IARI maintains information about vegetable germplasm collection of varieties released and the new varieties under trials. At present, the information is maintained on 14 out of 45 and odd number of vegetables grown in the country.

Fruit Register

For various new varieties of fruits released in the country, the Horticulture Division of IARI maintains the register. The retrospective data on the released varieties is also compiled by this Division.

It is likely that a computerised information service, linking various germplasm collections with the assistance of FAO at international level, may be started very soon.

2.6 *Insect Collections*

There are about four million estimated number of species of insects in the world and more than one million estimated number in India. Out of one million 50,000 species have been identified and the collection of specimens are maintained at 3 centres in India.

Zoological Survey of India, Calcutta, maintains a collection of 26000 species, Forest Research Institute, Dehra Dun has a collection of about 17000 species, and Indian Agricultural Research Institute is maintaining a collection of 15,000 insect species. A comprehensive scheme has been recently formulated for insect identification wherein the three centres will participate.

2.7 *Fungi*

Traditionally, IARI has done the pioneering work on preservation, identification, n, classification and researches on fungi, right from the time of Butler till date. Today, it has built a collection of world fungi consisting of 31000 total number of specimens under'Herbarium Cryttogamae Indiae Orientalis'(H.C.I.O.).

Indian type culture collection of fungi was started in 1936 at IARI with a view to furnish authentic culture of fungi for teaching, demonstration and research purposes. At present, the culture collection consists of about 1300 cultures of fungi including phytopathogenic fungi, moulds, yeasts and edible fungi.

2.8 *Nematodes*

The importance of nematodes as serious pest of crops has been recognised hardly four decades back. It is estimated that today more than 100,000 species of nematodes exists out of which nearly 11,500 species have been identified and described. In India, more than 600 species of soil and plant parasitic nematodes have been identified, out of more than 600 species of soil and plant parasitic nematodes have been identified, out of which 270 species of plant parasitic nematodes have been described. There are five and India.

The Indian Centre is located at IARI under the name of National Nematode Collection, IARI for South East Asia region. This centre has 914 type slides for 167 species and also 2404 permanent identified slides of 240 species. G.B. Pant Agricultural University, Pantnagar has recently compiled the list of nematodes.

2.91 *Botanical Survey of India*

The BSI with its headquarters at Calcutta and 5 circles located in various parts of the country surveys the flora of India and revises the Hooker's Flora of British India. It also maintains the Central National Herbarium and Indian Botanic Garden. The survey provides assistance and guidance for development of horticulture, agriculture, arboriculture, forestry, trade and commerce. The Survey also helps research scholars in their research projects on botany by supplying information and materials free of cost. The up-to-date data pertaining to Central National Herbarium and Indian Botanic Garden is not available.

2.92 *Zoological Survey of India*

This survy like Botanical one, has its headquarter at Calcutta and seven central regional stations located in various parts of the country. The headquarter and the stations carry out intensive field survey of various regions in order to enrich the National Zoological collection of the country, maintained at the headquarter. The survey maintains latest information on national zoological collections including insects. It procures fullest possible information about systematics, ecology and zoo-geography of the country and animal systematics.

2. 93 *Wealth of India*

This encyclopaedic work gives information about Indian economic plants, animals, minerals and industries. Amongst the economic plants it is covering over 1900 genera, on each species location, uses and various other economic aspects of plants, are given. The articles are written by carrying out a very comprehensive literature search. This compendium is very important source of information on economic plants of India. The first volume was published in 1948 and the last volume is likely to be published in 1976.

3 *Agricultural Libraries*

The specialized libraries play a very important role in providing information to scientists by building good collections of books and monographs and serials. Various ICAR institutes and agricultural universities have excellent libraries. The recent ICAR library survey has shown that over 600, 000 volumes are available with ICAR institutes and agricultural universities have more than 800, 000 volumes. Catalogue of these libraries are excellent information retrieval tools, some of the libraries like IARI have over million entries in the catalogue. CSIR system libraries have also over 600, 000 volumes according to a survey by INSDOC.

3. 1 *Serial Catalogue*

Fourteen serial catalogues of various libraries and regions have been published by INSDOC. Some of the agricultural university libraries and ICAR research institutes have also brought out the serial catalogues of their individual libraries and their total number comes to eleven.

4 *Other Information and Data*

In addition to the information given above, information about some surveys and other organisations in India is given below:-

4. 1 *Seeds*

On the basis of research conducted by All-India Coordinated Research Project, new varieties of seeds are released by ICAR. The Coordinators of All-India Coordinated Research Projects maintain data on quality and yield etc. about all the seed varieties of crops released.

National seed corporation in collaboration with State Seed Corporations and State Farm Corporation of India looks after the production and distribution of seeds to farmers.

4. 2 *Soil Survey*

The All India Soil and Land Use Survey carries out scientific survey and classification of the soils of the country. This is essential for proper understanding of the kinds of soils and for their exploitation to maximum advantage through planned land use on national basis. The object of soil survey is to classify and map the different kinds of soils with a view to plan properly the management and agricultural use of the soil resources.

Soil survey has so far issued various survey reports with maps. It maintains and up dates the data pertaining to the surveys it carries out. The soil survey has so far covered 27% land of the country.

4.3 *Soil Fertility Map of India*

Soil fertility map of India has been prepared by the coordinating unit of the Soil Science & Agricultural Chemistry Division of IARI. The map published in 1969 has been prepared by analysing over 1.3 million samples of soils. It covers 225 districts out of the total 325 in the country. These maps are useful in interpreting the relationship between soil groups and soil fertility classes Data on them is maintained by this unit.

4.4 *Central Ground Water Board*

It is now the apex scientific body at national level to look after all aspects of exploration, assessment, and development of ground water resources in the country. It also maintains related data.

4.5 *Pesticides*

Role of pesticides lies in providing an umbrella against the ravages caused due to pest out breaks. The Pesticide Association of India maintains information about progress of basic manufacture of pesticides in India. This includes insecticides, fungicides, rodenticides, herbicides, and nematicides. It also keeps information about import of these commodities in India.

4.6 *Machinery*

Information of commercial interest like production, distribution etc. of agricultural machinery and implements is maintained by the Ministry of Agriculture. The Agricultural Machinery Manufactures Association is also maintaining information.

The Machinery and Agro-Industries corporations in various states are probably maintaining data at the local level.

4.7 *Meteorology*

The Metereology Department carries out all the observations on meterology. They are bringing out various publications including periodicals and cummulations like "Monthly and Annual Rainfall and Number of Rainy Days 1901-1950''.

It has a Division on Agricultural Meterology which collects information of agricultural interest and acts as an information centre for this purpose. It also maintain various data, some of the topics covered by it are evapotranspiration from crops, evaporation from soil, practical soil moisture problems in agriculture, soil temperatures at various depths, influence of weather on crops in general, crop weather studies, crop weather calender, forecast for farmers, crop out put etc. etc.

4.8 *Directorate of Marketing and Inspection*

Data on marketing of agricultural commodities is collected and published by this organisation. It has excellent library devoted to this type of data.

4.91 The National Commission on Agriculture

The Commission has published over 21 interim reports on various aspects of agriculture, which embodies mine of information. It has collected enormous first hand data on various facets of agriculture. The final report when published by this commission, will be standard reference work on all aspects of agriculture for time to come.

4.92 Other Agencies

There are still many more organisations devoted to various other aspects of agriculture in our country, which we could not cover due to shortage of time, like irrigation, farm finance, storage, food technology, agro industries etc.etc.

5 Dissemination of Information to Farmers

Since agricultural activity is distributed over a very large section of the society throughout the country, the dissemination of information of agricultural importance is very vital, specially to farmers. This has been recognised and various agencies are operating in this area. The Department of Community Development, Department of Cooperation, and the Directorate of Extension, agricultural universities and ICA institutes etc. are involved in this process.

5.1 Nature of Information to be Communicated

The results of research on aspects like new seed varieties, fertilizers, pesticides, storage problems and marketing etc.; similar problems relating to animal husbandry, dairy and veterinary and fisheries and availability of credit facilities etc. are to be communicated to farmers.

5.2 Media Used

A number of diversified media of communication is used like printed information in the form of books, pamphlets, charts; audiovisual media namely, radio, television etc.; personal communication media like national demonstration centres, Krishi Mela, scientists and gram sevaks visits to villages and discussion with farmers.

6 International Sources of Information

At the International level, there are various agencies and organisations which are involved in collection and dissemination of information on agriculture. The most important one is the Food and Agricultural Organisation of United Nations.

6.1 FAO

Its Statistical Division is a prolific compiler, which collects, collates and disseminates numerous statistical data publications on various aspects of agriculture. It includes periodicals, annuals, bulletins, monographs and reports. FAO also publishes the 'World Census of Agriculture'.

6.11 *Aglinet*

The FAO is linking various important libraries in the world under the AGLINET system. This network will be a very useful source for obtaining documents or copies of documents from libraries by scientists in the world on any aspect of agriculture.

6.12 *AGRIS*

The FAO has sponsored a net work of agricultural information agency in the world under the name of AGRIS (World Agricultural Information System).

AGRIS has two levels of activity. At level one, it is publishing the AGRINDEX by getting the input of research papers from various countries of the world. AGRIS level two will involve information pertaining to research projects and other data of agricultural interest.

6.2 *Commonwealth Agricultural Bureaux*

The abstract journals form one part of the range of services in agricultural sciences provided by the CAB and provides a total of well over 100,000 abstracts and citations each year. They constitute one of the comprehensive coverage of the world literature on agriculture and related sciences. The CAB is subsidised by the contributing countries. From 1972, the abstracting journals are being produced by computer techniques and a consolidated data base is being created from which new services will be developed. Most journals are being issued monthly. In due course of time, all data will be available on magnetic tapes.

The CAB currently publishes 19 abstracting journals in agrobiological subjecsts.

6.3 *National Systems of Information*

In addition to international information generating and monitoring sources, there are a number of national centres in the countries of the world. The Agris has made a survey of such centres and published various reports. We are briefly describing here a few important ones in USA, USSR and France.

6.31 *U.S.A.*

In U.S.A., the approach for information monitoring is decentralised. Various setups like the Chemical Abstracts, Biological Abstracts etc. exist. The National Agricultural Library compiles the Bibliography of Agriculture and the Medical Library complex publishes the 'Index Medicus.' The Atomic Energy Commission publishes the Nuclear Science Abstracts. Various committees have surveyed the national information activity in science and technology in U.S.A. There are a number of federal computer based information system in USA out of which the following two maintain information about current research projects (1) U.S. Department of Agriculture has the 'Current Research Information System (CRIS)' covering research efforts of 6 USDA agencies, 53 state agricultural experiment stations and 25 other cooperating state institutes. At the moment, it has nearly 28,000 projects of research listed. (2) The Science Information Exchange (S.I.E.). This covers the ongoing basic and applied research in science and technology. Currently, it has over 800,000 documents of research projects 100,000 documents of research project are added annually. MARC tape of Library of Congress is well known to this audience.

6.32 U.S.S.R.

In USSR, the information processing is centralised to a great extent. The Institute of Scientific Information of Academy of Sciences of USSR was contemplated in 1952 and was converted into 'All-Union Institute of Scientific and Technical Information in 1956 (VINITI). At present, it publishes the Referativnyi Zhurnal in 25 series and in 33 parts, monitoring over a million items of information.

In addition to this the VINIMI publishes the Medical abstracts Journal in 13 different series, CINI is monitoring information on building and architecture.

The VINITISH (1965), the All-Union Institute of Scientific & Technical Information on Agriculture is responsible for information on agricultural subjects. This is currently offering abstract cards in some 43 subjects in agriculture which is replaced by Referativny Zhurnal in Agriculture from 1969. In addition they have an Express Information Service.

The Central Library of the Ministry of Agriculture Publishes a 'Monthly Index of Agricultural Literature' of the USSR listing over 60,000 titles in a year. In addition a bibliography of foreign agricultural literature is also published listing over 30,000 entries.

6.33 France

Centre National de la Researche Sciencfique (CNRS) was started in 1939. They publish the 'Bulletin Signaletique' in seventeen parts. In addition to this six others are published on human sciences. It now includes over 500,000 references per year.

7 Information Network in India: NISSAT

We are meeting here to discuss about the national information system. We have outlined the various data sources in agriculture in this article. If a computer based system for agricultural information retrieval is to be set up, many of the above mentioned data will have to be scrutinised and essential ones may have to be incorporated in the system.

The role of IARI Libary in the Network

We feel the Library with its resources and facilities can play a very vital role in the information network, and its Bibliography of Indian Agriculture. When published, will be a source data for incorporating in the AGRIS and National System.

PAPER E-1

DEVELOPMENT OF COMPUTER-BASED INFORMATION SERVICES IN INDIA

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Traces the historical developmental work in harnessing the computer for information services and products. Describes the present status of computer-based information services. Discusses the existing trends of the development in the advanced countries. Concludes with the presentation of alternatives for developing computer-based services in India. Suggests the necessity of setting-up of a batch mode information networks which could enhance these services and products.

Introduction

A narrrative attempting to trace the developments in any field of human activity tends to become a historic account in which the few pioneers occupy large share. This topic is no exception to this. Looking back from the end of 1976 few organisations and few applications dominate the horizon and the forward sweep indicates vast potential. A comparison with other countries in the world reveals that India has not been lagging much behind the most sophisticated countries – at best this gulf could yawn and cover a period of little over five years. The development of computer based information services commences in 1963-64. The consideration of topological and techno-economic characteristics become imperative to furnish this account with appropriate backdrop for better appreciation.

India - The Action Scene

India the action scene has its own problems and peculiarities. Particularly in the Information Services. Geographically it is a land of varied terrain with activity centres separated by long distances. Demographically India is the second largest country in the world. Its intellectual, R&D and industrial activity is concentrated in over a dozen places. Speaking techno-economically India has all these characteristics which specify a developing country. The country has made significant progress in techno-economic sphere. On the information and library scene the country has a tradition of over a century. There are well stocked libraries dotted all over the sub-continent. No body precisely knows 'how much and where?' These institutions are braving the travesty of information explosion, paper blizzard and budgetary famine. And on the computer or data processing side the country has come to third generation computers in 1970-71 from the punch card era of 1960's. During 1964 couple of second generation general purpose computers were available. Now there are about six third generation and even a 370/155 system available. Inspite of a just pride can be taken

in the space, Atomic Energy, industrial researches and the NISSAT, the statement "India is too weak to matter and too large to ignore" is still valid in almost every sector of human endeavour.

Early Attempts

INSDOC took the leadership in experimenting with the computers for their application in documentation and information work in 1964. The computer that was available to the Experimental Cell then was IBM 1620 model I at IIT Kanpur and the first attempt was to do some work with data collected for union catalogue of scientific serials. The alphabetisation programme was developed and the punched card output was printed on tabulating machine [1]. Within two years in Delhi School of Economics another IBM 1620 model II with Disk drives and on line printer, became available. The first job on this computer system was the processing of the data for the 'Roster of technical translators in India' [2]. This was followed up by experiments on Data Retrieval [3], Processing of data for author and subject indexes to Indian Science Abstracts [4, 5]. An attempt was made to develop the complete and integrated program deck to process Union Catalogue for Mysore State using IBM 1620 at Delhi School of Economics in 1969. The constraints of the computer system presented problems for this data file, though finally the main part with indexes was produced [6]. This was the last work developed for 1620 and to overcome the hurdles of on-line storage limitation, this work was completely redesigned and executed on IBM 360/44 at Delhi University Computer Centre [7]. It will become evident that so far the use of computer by Insdoc has been limited to the development of information products only. With the close of sixties other organisations took interest and appeared in the arena.

DRTC Bangalore

The DRTC in its early stages used an ICL computer at HMT. They implemented the DOC finder system which was later on converted to IBM 1401. Prof. Neelameghan and his group developed a system for implementing the postulational approach [8, 9].

BARC Bombay

The early work at BARC was also on the development of the information product viz. catalogue of technical reports. It is now serving as the input centre to INIS system. They are now developing IR systems for INIS data base.

TIFR Bombay

During early 1970's the TIFR Library developed a program system for generating their library catalogue based on annual acquisitions. [10]

IIT Madras

In the same period the IIT Library developed programs for converting their Union Catalogue into Computer readable form. The IIT Computer Centre developed Policy Information System and Hospital Information System.

Present Situation

This account, by no means exhaustive, of early developments leads to the present situation where the advances in communication, computer and reprographic technologies are joining hands to give new dimensions to computer based information services. New concepts like on-line interactive systems and information networks have appeared on the world scene. A look of these may provide a clue to the course which India may choose in future.

Data Bases

Data bases used here denote the bibliographic data bases as opposed to factual data bases. The major difference between them is that the former is data dependent and the latter has to be data independent. The bibliographic data beases incorporate the surrogates like author, title, source, keywords, abstracts, etc. of information published in different parts of the world. These are mostly on computer readable form as magnetic tapes. Generally these correspond to the hard copy version of various indexing and abstracting services. Currently there are about fifty data bases covering over six millions items of published information. Some of these data bases are multidisciplinary like Chemical Abstracts Condensate, Compendex, etc. while others are mission-oriented like NSA, INIS, etc. Some of these data bases are centrally generated like CAC, Compendex, etc. while others are generated out of a decentralised input like Agvis, INIS, LIBRIS, etc. Without being exhaustive the following table gives the idea of variety of data bases now avilable.

These and other data bases are available on lease basis or on special contract or through a specific communication network. These data bases immediately provide an access to world's literature not only in science and technology but also in social sciences and humanities. With the help of suitable computer and communication hardware the information contained in these data bases can be accessed at a very fast speed. These data bases can be used to furnish a variery of information services and information products.

Computer Technology

The present computer technology offers a 30% cost reduction every year and 10% increase in processing capability. It is possible to use any large computer system from any point on a on-line basis provided appropriate communication technology exist. The days of owning large computers are now receding. The mini- or microcomputer network with a large computer access is gaining grounds. The availability of intelligent or otherwise terminals opens up vast field of interconnected computer networks having different computers serving as nodes. As a matter of fact there are a few such networks existing in the world. The Lockheed, the SDC, and the ESRO network are international in scope. Whereas NRC, LIBRIS, Q/L are networks of national scope.

Information Nets

The progress in the computer technology and its utilisation, the growth in the communication technology opened up a new vista in information technology yielding new products and services. One such dynamic concept is the emergence of information networks. Information network revolves round the concept of centralised computer processing of data bases and decentralised dissemination of information, including the

TABLE 1

Computer-readable Package	Field Covered
ABI-INFORM	Business
FORTUNE	"
TELELIST	Stocks & Bonds
NEW YORK TIMES	News & "Olds"
ENVIRON	Environment
AIR POLLUTION ABSTRACTS	"
IRRD	Road & Highway Research
HRIS	" " "
GEO-REF	Geosciences
WOOD	Paper Pulp & Forestry
API ABSTRACTS	Petroleum
API PATENTS	" Patents
AGRIS	Agriculture
CAIN	"
CRIS	"
TITUS	Textile
TTD	"
SSCI	Social Science
STAR	Aerospace
PANDEX	Science & Technology
SCI	" "
MECH EN	Mechanical Engineering
COMPENDEX	Engineering
PASCAL	Engineering & Physics
INSPEC	" "
SPIN	Physics
INIS	Nuclear Science
NSA	" "
METADEX	Metals
ELDOK	Electro Technology
EMA	Electronics
CIN	Chemical Industry Notes
CA CONDENSATES	Chemistry
CPI	Chemistry Patents
POST-P	Chemistry Patents of Polymers
RINGDOC	Pharmaceutical
EXCERPTA MEDICA	Medicine
MEDLARS	"
ERICTAPES	Education
FSTA	Food

nodal functioning of some information centres which have the nucleus of network which has the computer facilities and data-bases availability. Sometimes such nuclei are interconnected and made available to a number of nodal points with a view to provide access to a larger cross-section of data bases. Needless to say that these network operation is in two ways. One is a dedicated system like Dialog or UOCS ORBIT, or Q/L. The other is time-shared mode like CAN/OLE, REKON, VEERA-III. These information network have international, national and regional scope. International networks are DIALOG & ORBIT. The national network are CAN/OLE, ISIS, REKON, LIBRIS etc. The regional networks are UOCS, Q/L-systems.

It is possible to have batchmode information networks. CAN/SDI is an example of such a network. In this type of network all the computerised processing is done centrally and normal portal channels are used for delivering customised current awareness service. In CAN/SDI network the input and the output is screened by a mesh of search editors located throughout Canada.

Development Alternatives

India is in a vantage situation for selecting the most appropriate model for computer-based information services at a national level and at the regional levels. Most of these models have been tried and tested. Of course, to some degree these models are machine and hardware dependent. However, the development cost for a de novo system can be avoided by judicious selection of current hardware. Some guiding factors are presented here.

Information Bases

Every country generates its own information and in our country this information is available in about fifteen hundred primary publications - technical reports, patents, standard and theses excluded. For an integrated information system this must be made available in the form of data base for sale, lease or exchange. The requisite computer operations will generate a large number of information products like current specialised or generalised bibliographies which could printed from a single keying operation using computer typesetting and photo-composing. Such a data base could be created as per international standards to facilitate information exchange. The integrated IR systems providing current awareness services and retrospective literature services can also make use of such a data base alongwith the imported data bases. If these data bases are used in conjunction with other data bases being currently developed by Insdoc like On going research projects, Union Catalogue, etc. a wide range of services for planning, controlling and monitoring of R&D activities in India could emanate.

Information Networks

Information network is logical and economic proposition towards which all systems, services and products gravotate. Information network is device to share the available resources by the way of information sources, skilled manpower, software and hardware. The basic concept underlying the information network is the realisation of the fact that information is a commodity or a form of energy which must be made available to anyone who has a potential to use it.

On-time interactive information network is matter of future for India in view of the availabilities of computer power and the state of communication systems. This

technological gap does not rule out the possibility for an information network in India. The technology, the communication and the existing facilities do indicate the probability and feasibility of a batch mode information network. In this network the choice is one a hand dedicated, strong, and large computer system for centralised processing and a mesh of information centres and information specialists for decentralised dissemination and input. The other alternative to this is a decentralised processing nodes at centres where computer power is available and strong nucleus of this network to provide standardisation of services and products, skilled manpower, enlightened leadership and effective coordination. All these will have to be achieved and geared for batch mode of the network with a built in switch for converting it to interactive on-line network.

The Environment

Present environment for computer based information services is having many favourable factors. The existence of Unisist at international level and of NISSAT at the national level are two dominating and beneficial situations. One gives a platform for interfacing with international systems. As a matter of fact with the aid of Unesco on behalf of Unisist a pilot project on computer based SDI will be shortly established in India not only for India but also for the region. The NISSAT reflects the magnitude of the governmental interest in the information network for the country. The interaction of Unisist, Unesco and NISSAT will no doubt yield a new philosophy for a novel type of information network which will be based on the realities of technology, socio-economic facts of developing nations. The implementation of this philosophy will mean considerable amount of experimentation in modelling and moduling. It is hoped that necessary funds for this may be esasily forthcoming from NISSAT.

Conclusions

Extensive work with two generations of computers over a period of decade of years has timely established the following:

- One of the advantage of computers is speed e.g. one monthly tape was processed in 188 milliseconds searching 1,000 documents for one term. That is about 5,000 documents in less than one second. Other operations like listing, storing, etc. are performed with similar speeds and efficiency;

- Computers in IR save the librarian's time which may be more effectively used in studying resources, subject area and user need;

- Computerised services open new access to the library holdings and enhance their usage.

- Magnetic tape data bases reach earlier than the hard copy version as these are issued earlier. Certain elements of advance information service yields more user satisfaction;

- Magnetic tape data bases can be processed in a variety of ways e.g. Marc tape can be used for accession cataloguing, then in SDI mode, later in a retrospective search and finally in some of indexes;

- Users profile may be easily updated, revised and run and the cause of hits helps in adjusting a profile;

- The quantity of desired output may be pre-specified in a retrospective searches;

- There is a larger users satisfaction participation and servicing possible;

- Computerised service can be viewed as an improvement of traditional service, it reaches users rather than observing the "side-and-wait" attitude;

- Computerised service saves user's time as well. A narrative and a few keywords is all that he is required to do;

- Computer files save storage space and are compact.

These have given us a faith that computer based information service is the near future for India and the days of on-line interactive systems are not too far off. There must not exist any doubt in this and we must prepare ourselves for this inevitable change for optimising the user satisfaction if not for anything else. In this the leadership is to come from NISSAT.

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Paper E-2

MANPOWER DEVELOPMENT FOR INFORMATION WORK

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Introduction

In recent years, there has been an increasing appreciation of the vital role of information in the national development of the country. The thought and attention given by the Department of Science and Technology towards evolving a national information system (NISSAT) and the planning for the setting up of the National Informatics Centre are clear evidences of this appreciation. While this is most welcome and certainly a step in the right direction, the task of designing, organising and operating a national information system is indeed challenging that calls for great ingenuity, imagination and expertise. The different type of specialised skills that are required for the development of a national information system, are not readily available in the country at present except in a rudimentary form. Manpower development, is therefore, an immediate task, on which lies the success of the programmes that are being chalked out presently in the country.

The National Plan for an Information System

The structure envisaged for a national information system comprises of a few coordinating national bodies at the apex, with a number of branch information centres, specialising in a specific field — discipline/mission/product oriented — and other local units devoting entirely to particular institutional activities. Thus the complete national information system will constitute a total network, interacting with each other and providing appropriate services at various focal points. The national information system is expected to meet the diverse requirements of planners, policy-makers and those that are involved at the implementation stages in the government, R&D personnel, business and industry, academacians, scientists, engineers, managers and others working at different positions and organisations. The institutions that will singly and collectively meet the demands are likely to be libraries, documentation/information centres, information analysis centres, data bases and banks, clearing houses, deposit centres, translation centres, etc. These organisations and their services will be backed up and supported by planned developments in computer and telecommunication networks and reprographic facilities.

Quality of Services to be Expected

The deployment of a sizeable financial outlay, manpower and time would naturally have to be geared up to meet adequately the pressures for information. The

main pressures will be for the provision of more accessible, faster, more comprehensive and more standardized statistical information systems, coordinated on inter-disciplinary and international bases. The systems will be required to operate Selective Dissemination of Information (SDI) services, carry out retrospective searches, and if required, process the data stored (for example, carry out statistical tests, compute correlations and carry out various other analysis). The need for complex techno-economic-social analyses will require the linking of some of the existing systems in science, technology, and the social sciences, with the statistical systems. Sub-systems will be required for planners at the local and regional levels.

Specialised data banks will increasingly be introduced in a wide variety of institutions and in support of different aims, not only for research and development, but also for production, marketing, and other service functions. Examples of such systems are those that are already serving pharmaceutical research, preventice medicine, crime prevention and detection, ionosphere and weather forecasting, insurance, patent and legal work, etc.

Required Manpower

Keeping in view all the demands that are very briefly sketched above, a wide variety of specialists are to be trained to constitute the manpower force for the national information systems. Taking into account the experience obtained thus far in our country and other countries wherein information systems have been well developed, the types of personnel required may be stated as follows: Information scientists, Librarians, Computer specialists, System analysts and Manager, Technical writers and editors, Translators, Reprographic specialists, Subject specialists with an orientation in information science.

Information Scientists includes senior professional personnel with high academic degrees, who will bear major responsibilities in the information systems.

Librarians with library science degrees responsible for building the libraries and organising services therein.

Computer specialists include personnel for the handling and operation of mechanised and automated processing equipment such as programming personnel, operating staff, computer service specialists and others directly involved in the maintenance of computers and auxiliary equipment.

Systems analysts and Managers are to be associated in situations where advanced data processing systems are maintained including coordinating automated data processing activities.

Technical writers and editors include specialists who could reprocess and re-package information suitable to different types of needs and also prepare technical reports and reviews.

Translators are language specialists skilled in translation work. Subject specialists who contribute to the different types of analysis of information required in an information analysis centres.

The categories of work for which these types of personnel are to employed are: (1) Production and Operation; (2) Design and Development; (3) Applied Research; and (4) Background Research.

The production and operation category will perhaps take the largest of share of the total manpower required for production operation and maintenance of the information systems. Closer to this category, is the design and development personnel who will play a key role in all but the smallest operational units.

Applied research is required both to back-up the development and design effort and to provide the means of bringing the findings of the background research to the stage when these can be used in design. The applied research worker will need to comprehend the background research findings and analyse and synthesise these for the benefit of the design workers.

The background research, while fairly remote from the problems of day to day operation of information units, is required to provide the scientific basis for the development of new methods, and means in information science and technology. It will necessarily be closely linked with work in related fields, such as psychology, linguistics, communication studies and engineering science.

The quantitative requirement of manpower for the national information system will have to be assessed only after a full survey of the existing turnover of candidates available for information work and other related problems.

Education and Training

Education and training for information science are very basic to the proper development of manpower resource planning. What constitute information science has been a subject of debate throughout the world today. Generally speaking the field of activity of the information specialists may perhaps, be described operationally as that represented by, and in, such publications as the Annual review of information science and technology, Journal of documentation, Information storage and retrieval, Journal of the American Society for Information science and abstracting publications such as the Library and Information Science Abstracts, Information Science Abstracts (USA) and Referativnyi Zhurnal: Informatica together with areas in some neighbouring fields such as human communication, psychology, and linguistics. Very large areas of modern librarianship and areas in data processing are included in the field.

In this context, it would be worthwhile to draw attention to a useful publication of Herbert Schur, a member of the Faculty of the Post-graduate school of Librarianship and Information Science University of Sheffield. This work was a study of educational programmes for information specialists, done for the Organisation for Economic Cooperation and Development (OECD). The objectives were the construction of sample curricula for information specialists as well as the identification of gaps in existing curricula. After an elaborate survey, the sample curricula constructed by Schur are identified in terms of the following three facts: category of work (operation, design and development, applied research and background research); level of work (technical assistant, first professional, second professional and advanced professional); and branch of specialization (programme for information specialists to be concerned with substantially natural-language-based systems, programme for information specialists with symbol-, graph or similar-based systems, and "matching section" programmes for specialists in other fields for specialised information system work). Topics to be taught in each of the proposed curricula are grouped into the following six broad areas: generation and use of data bases; data bases and their characteristics; organisation and dissemination of data; information storage and retrieval systems; theoretical and technical tools; and special topics e. g. advanced computer programming and organisation. More

specific topics are listed under each of the broad area. For example, under organisation and dissemination of data, the following more specific topics are listed; data acquisition, description, compression; taxonomies, classification of data, indexes and indexing; file structures and organisation for retrieval; data transmission, communication, dissemination. This report provides a useful framework for describing the work performed by different types of information specialists and also a offers a specimen curricula for various types of information specialists.

Existing Manpower Resources in India

Of the different types of personnel required for manning the national information system, one segment viz., supply of librarians, has been fairly well taken care of, thanks to Dr. S. R. Ranganathan who laid the firm foundations for education for librarianship. There are forty universities in India today offering courses in library science at the first professional degree level and ten are offering courses at Master's degree level. Some of these universities have provisions for research, leading to doctor of philosophy. Besides a few state library associations conduct courses at semi-professional levels and a few polytechnics for women train girls in library science at undergraduate levels. The annual turnover approximately works out to 1250 professionals and semiprofessionals.

Training for documentation/information commenced with the establishment of the Documentation Research and Training Centre (DRTC) at Bangalore in 1962 under the auspices of the Indian Statistical Institute, again a contribution of Dr. Ranganathan. In 1964 the Indian National Scientific Documentation Centre (INSDOC) started the training course in documentation and reprography. These two institutions turnout on an average about twenty students every year. These two courses have kept the country's requirements constantly in view in framing the syllabi and compare very favourably with any international course. Research organisations, public undertakings, academic and technological institutions have taken advantage of these courses. Besides the training facilities, DRTC have been engaged in basic and applied research making significant contributions to the field. Most of the university library schools have provided a paper in documentation at their master degree level courses.

Although there are no computer course specifically oriented towards information, the Indian institutes of technology have been offering computer courses which have been utilised by quite a few librarians and documentalists, for information and library work.

Some of the management training institutes in the country have been conducting short term course in systems analysis and management information systems.

For the training of scientific and technical translators Insdoc was conducting a full time course for four years beginning from 1964, for Russian language. This has been suspended temporarily. Some of the foreign language departments of universities provide training in technical translation. The Indian Scientific Translators Association have programmes for instituting full time courses for technical translation in different languages.

There are no courses in reprography for technicians. Insdoc's training course offers a full paper in reprography. A paper in technical writing has also been introduced since 1974 in this course, a formal training in technical writing being offered for the first time in the country. The expertise available at the Publications and

Information Directorate of the CSIR and the Indian Standards Institution has been made use of, for this purpose.

Short Term Courses

Short term programmes in information services extending over two to three weeks have been organised by the Small Industries Extension and Training Institute (SIET) for the last two years. The Department of Science and Technology have sponsored a crash programme for grafting scientists and engineers into information work and two eight-week courses have been jointly conducted by DRTC and Insdoc this year. These two courses have been very well received.

Future Requirements

Notwithstanding the efforts taken by the various institutions in the country in building up the manpower resources for information work, this touches only the fringe of the problem. While augmenting support for the existing institutions who supply the manpower now, every attempt should be made to attract the right type of persons into the profession. Unless there are good career opportunities available in the information field, it would be difficult to attract engineers, technologists and scientists into the field. It has been our experience that those working as engineers and scientists at different levels, who are inclined towards making a contribution to the information field, are not prepared to drift to information work, because the opportunities here are not as bright as in the other field. In this context, it may be mentioned that the recent decision of CSIR to put information scientists on a par with research scientists is a very healthy trend and would certainly go a long way to retain and attract the right type of people.

Apart from courses for turning out professionals in the information field, short term courses for computer specialist, systems analysts, subject specialists and others to get a proper perspective of the information field is necessary.

Conclusions

In the foregoing rather cursory account, an attempt has been made to highlight some of the problems relating to manpower development for information in the country. A more systematic qualitative and quantitative study and follow-up action for building up an information cadre are absolutely necessary as we develop an information system for the country.

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Appendix I

Relation between information institutions, Types of personnel and Training